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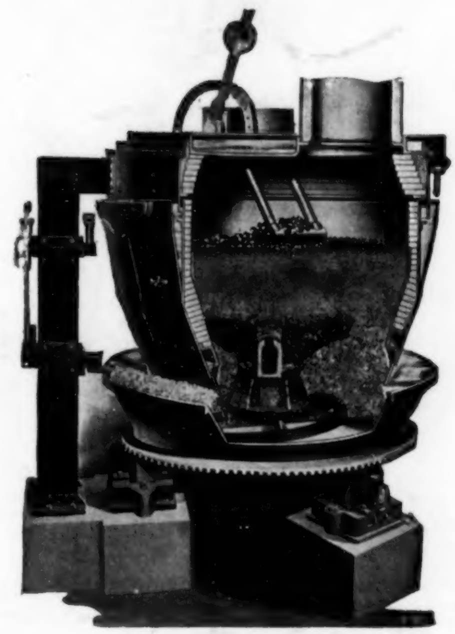

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. Parmelee
Editor

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Science—Pilot of Progress

"I SAT next to a wealthy man at a dinner who saw that I was unversed in business and therefore condescended to descend to my level and talk of science. He mentioned the great development of electricity in industry—the motors, the dynamos and the other machines that have benefited mankind. I suggested that perhaps Faraday was entitled to some of the credit for the development. 'Faraday? Who is Faraday?' was his comment."

It was Professor Michelson, of the University of Chicago, talking at the centennial of Rensselaer Polytechnic Institute. His plea was for research in pure science. Engineering, the daughter of science, is respected and welcomed by industry because the practical results, the human benefits, the dollars-and-cents values are obvious. But industry glancing through its pragmatic spectacles raises eyebrows in surprise when research in pure science is discussed. Industry does not understand. Practical results are too remote. A genial tolerance, perhaps, but no support!

And yet this is not fair to humanity nor to industry. It is our problem and a very real one to discover some way of advancing research in pure science. Briefly, it is this: If civilization is to progress, research in science must go on. Men capable of research—of real research, not the pot boiler variety—must be persuaded to stay in such work. Industrial prizes are too alluring now and the man capable of constructive work in science is tempted to sell his soul for a mess of pottage. Who shall blame him save perhaps his colleagues who have not been tempted?

Unless the worker in science can view his research as an artist views his picture and work for the pure fun of it, he can hardly succeed. This again from Professor Michelson, who, as president of the Academy of Sciences and as a most distinguished scientist, commands a hearing. What a far cry it is from research for the fun of doing creative work to the trouble-shooting "research" that most industries foster or indeed to the dismal "prerequisites" that the average instructor and assistant professor publish in order to win promotion! Here and there in industry and in universities there are bright spots—workers with imagination, looking beyond the horizon. They are the hope of humanity. Their research may never have practical application, but without their research there would be stagnation.

Faraday had once explained his experiments on magnetism to a friend—a peer of England. They were the experiments that lie at the very heart of electrical development. "But of what use are they?" remarked his lordship. To this Faraday made a memorable reply that should forever answer thoughtless criticism of scientific work. "Of what use is a baby?" he said and inevitably there comes to mind the infinite possibility of that little life. If fed and educated and disciplined, that life may be of great use to mankind. This is the challenge of science. It demands of us, as engineers and industrialists, enthusiastic support, perhaps even at the expense of our immediate pocket books.

Edward Hart—Citizen

A DISTINGUISHED assemblage of scientists, educators, industrial men and others gathered to honor Prof. Edward Hart on the completion of his 50 years of service to Lafayette College. The speakers were able and eloquent. They brought many messages of congratulation and inspiration, but the theme that ran through many of the addresses and that stirred those present perhaps more than any other was "Edward Hart—a good citizen of Easton." In all of his varied career, as chemist, manufacturer, printer, educator, farmer (and these, by the way, were concurrent vocations, each one of them successful), Dr. Hart was never too busy to devote himself to civic affairs. Many there were to testify to the effort involved in this unselfish service, which must stand out as an object lesson to his colleagues of proper devotion and of true neighborliness.

Hurdling Traditions

ALTHOUGH lumbering and woodworking are somewhat foreign to the interests of most of our readers, the method developed at the Ford Motor Co. for producing wooden motor-body parts is such an excellent example of the triumph of common sense over tradition that we feel it worthy of brief outline.

Under conventional methods of edging and trimming, attention is focused on the production of straight logs of standard length. These are cut into boards, kiln-dried and the parts cut from the dried boards. One-third of the tree, including butt, limbs and top, is wasted before the log gets to the mill and only 55 to 60 per cent of the log is converted into body parts.

With the Ford system, planks with the bark left on are cut from a log in parallel planes varying with the shape of the log. These are sent to layout tables, where patterns for the various parts are marked out until the entire surface is covered, just as the shoe manufacturer obtains the maximum number of parts from an irregular piece of leather. The parts are then cut out with a high-speed band saw and kiln-dried, allowance for drying shrinkage having been made in the pattern. It was freely predicted by the old-timers that the system would

fail at this point, and they were rather chagrined to find that the parts came through with less warping and end-checking than the boards.

Data on an actual comparison are startling. A tree was taken that gave two irregular logs scaling 238 board-feet. Under the old system this is all that would have been available for parts and it was calculated that 127 board-feet of parts would have been obtained from these logs. Upon cutting them by the Ford system 204 board-feet was obtained and in addition 170 board-feet from limbs and tops, hitherto worthless except for distillation or fuel, making a total of 374 as against 127 board-feet from the same tree. Such a conservation of natural resources is of tremendous importance and it is because of this aspect that the Ford Motor Co. has made public the method.

Logic or Precedent In Technical Literature

A JOURNALIST was reported to have made the observation a few months ago that whereas formerly mention in the *Times*, of London, was the index of distinction, the success of the writer of non-fiction was now indicated by the acceptance of his contribution as worthy of abstraction by the editors of the *Literary Digest*. This places us where we can speak with a measure of authority, because articles and editorials in *Chem. & Met.* often find a wider audience in consequence of their reappearance in that popular weekly. We are inclined to congratulate ourselves that simplicity and sincerity in method of presentation are partly responsible; and, being thus armored with a sense of self-respect, we feel justified in taking issue with the authority who occupies "The Lexicographer's Easy Chair" on the subject of the use of the word "either," when "each" or "both" is meant. We discuss this because the principle involved affects many other words in common use.

A correspondent, "R. P. L.," of Philadelphia, politely asks in the Sept. 20 issue of the *Digest* if "either" is correctly used in three examples in recent issues, one of which is as follows: "By means of a special synchronizing system the cylinders at *either* end of the line . . ." "Is another form preferable?" he asks. "No," bluntly replies "Lexicographer," who proceeds to explain his attitude thus: "The writers of the examples cited were satisfied to make use of the word in a manner that has ample support for that use." This support is apparently based entirely on prior usage, and a quotation is given from a book by "Jack O'London," who maintains that "good English follows clear thinking rather than that system of rules called grammar, which youth loathes and maturity forgets." We are willing to admit that "either" has been used and is being used extensively to indicate "both" or "each," but we take exception to the assumption that what is clearly a repetition of an absurdity is an example of clear thinking. We claim maturity in having forgotten most of the grammar we ever learned. We make mistakes, as all mortals do; but we do not stick to them when they are pointed out to us.

According to the *Digest* authority, "either" has been used to mean "each" or "both" for more than 300 years, which is given as an adequate reason for continued obfuscation. We do not approve this conclusion. We find in our work that precise description is impossible unless words are used, in so far as possible, in their primary sense. Moreover, a sharpened chisel that has been used as a screw driver is no longer useful for fine wood carving. Similarly, a word frequently used inaptly is unavailable when need arises for its employment in precise description or pointed comment.

The scientific progress of the world in recent years has been due in no small measure to a recognition of the superiority of logic over precedent. It is unreasonable not to use a word in its primary sense when it is available, despite the custom of centuries among writers not discussing technical matters.

Mr. Ford's Praises For Wall Street

RECENTLY Mr. Ford made a singular comment on Wall Street. It was strange not alone because of its political implication in associating LaFollette with the "vested interests," but also because it cast Wall Street in the strange rôle of industrial benefactor. These were Mr. Ford's words:

> Wall Street is progressive and possibly indispensable . . . It takes the dying success, squeezes out the last drop and tosses it away . . . In killing off the antiquated and obsolete, Wall Street does a service, for an industry that cannot withstand such squeezing as Wall Street may give it had better die.

During the past few years some of our industries have passed through a period of banker control. A few have luckily emerged and with a sigh of relief are making reparations for the years of blight in which plant improvements were taboo and capital investment, research—in fact, everything—was poured out for dividends. In several other instances—such, for example, as fertilizer and vegetable-oil manufacture—what seemed to be great industries have been thrown on the scrap heap. They proved to be mere shells carried along for years by the good names of the reputable banking houses that supported their stock issues. And, finally, there are a number of outstanding companies—still dominated by the banker—which seem to be tottering on the very edge of dissolution and perhaps of destruction. To call this service progressive and indispensable is even greater irony than Mr. Ford intended.

Heat of Wetting as an Index of Soil Colloidity

RESEARCH at the Michigan Agricultural Experiment Station on the quantitative estimation of the colloidity of soil has deflected attention to thermal effects, with the result that an ingenious method of examination has been evolved. In a recent issue of *Science* Dr. G. J. Bouyoucos outlines the progress made and briefly summarizes the fundamentals underlying the research and its object. The heat of wetting of a soil, it is maintained, is due entirely or almost entirely to the presence of colloidal matter; non-colloidal soil material does not produce heat when wetted. A highly colloidal soil after calcining has been proved to possess when wetted none of the thermal characteristics of the raw product, a circumstance that adds weight to the theory on which the work at East Lansing has been based. Moreover, no amount of fine grinding of the burned soil will restore the thermal characteristics peculiar to the raw material. For the practical utilization of these results, Dr. Bouyoucos proposes a method of soil testing by which the heat of wetting of an entire

sample is estimated, then the heat of wetting of a separated sample of contained colloid; from which the colloidity of the whole is obtained.

These investigations should have a far-reaching effect on determination work in which an estimate of colloidity is necessary—in ceramics, metallurgy and general industrial chemistry—and the full results of the investigations at East Lansing will be awaited with interest.

Standardization in The Oil Industry

THREE years ago at a meeting of the American Petroleum Institute, J. Edgar Pew, of the Sun Oil Co., put his finger on a sore spot in the petroleum industry. One of the most serious wastes in oil production—and an inexcusable one, since it can largely be avoided—is due to the multiplicity of sizes, grades and qualities of well casing, pipe and other "oil country goods." This month at Tulsa the director of standardization for the American Petroleum Institute reported that the industry has not only awakened to its obligations but in a comparatively few months has made progress that is little short of marvelous.

On other occasions we have pointed out in these columns how in the frenzy of flush production a piece of well casing assumes importance far out of proportion to its inherent worth. After it has been rushed across the continent or shipped half way around the world to some foreign oil field and finally finds its place several thousand feet beneath the surface, its failure at this juncture may mean either the loss of the well or a delay that delivers the oil to a near-by competitor. This is where uniformly dependable quality is a prime consideration. Sometimes, too, when the unexpected happens, a company may have to make a hurried call on a neighbor or on the local supply house to borrow a few lengths of casing. If the borrowed casing happens to be of a different make, the chances are it will have to be rethreaded before it can be fitted to the sections already in use. Here is where a standardized casing would save time and trouble. The specifications and description of casing present another anomaly. Except in the case of extra large sizes of pipe the nominal size is neither the outside nor the inside diameter—but is a number based on an arbitrary method of classification. A simpler method and one that really means something would be the use of two significant dimensions—the outside diameter and the weight per running foot.

These cases are sufficient to show the need for the standardization effort. The interesting thing is that all of these difficulties are finding their solution in the industry's program. A better check on quality is provided, since the new specifications deal with every phase in the manufacture of tubular goods, setting definite limits and working tolerances in every stage of operation from raw material to the inspection and testing of the finished product. A limited number of sizes have been agreed upon and when conforming to the new specifications the pipe is to be officially recognized and identified as "A.P.I. casing." Both the manufacturer and the user of the pipe will be supplied with every necessary dimension and property and instead of being classed by nominal grade the sizes of the A.P.I. casing will be known by their actual outside diameters.

The enthusiasm with which the petroleum industry has supported this program of standardization indicates that the future effort may not be confined solely to oil-field equipment, although the immediate attention happens to be in that direction. There are plenty of instances in the refinery and in the marketing of petroleum products, particularly of lubricating and fuel oils, where simplification is sorely needed. This is the sort of progress that eliminates wasteful effort and benefits both the producer and the consumer. The petroleum industry will do well to follow through.

The Economic Basis For an Oil-Shale Industry

HOW much is it going to cost to produce shale oil on a continuous, commercial basis? As might be expected, estimates differ widely, for, except perhaps in one or two instances, operations in this country are on a frankly experimental scale. The question is nevertheless of real interest, for it is basic to practically every other consideration in the possible industrial development of oil shale.

In one of the articles in this issue where attention has been given to the component elements that make up the estimated cost of shale oil, the author arrives at the rather unsatisfactory conclusion that the total cost may vary between 87 cents and $3 per barrel. This would seem to be but another way of saying that, for practical purposes, the question is still unanswerable.

It calls to mind a question that some of our friends in the petroleum industry have been pondering for a long time: How much does it really cost to produce petroleum? In 1922 R. L. Welch, testifying before a Senate committee, said: "I can think of no more hopeless task than to attempt to arrive at the fundamental cost of so complicated a thing as a barrel of crude oil. . . . It is my judgment that every barrel of oil which has been produced in the history of the business has been sold below the aggregate amount of money which has been poured into oil production."

Just lately some startling figures have appeared that would seem to confirm this view. E. W. Marland and C. C. Osborn, in a survey on behalf of the National Petroleum Marketers Association, found that the average cost of producing crude oil during the two and a half years ended June 30, 1923, was $2.17 per barrel when one considered only the actual expenses for drilling, pumping, bonuses and rentals. The tremendous overhead for geological exploration, interest, taxes and administration is not included. Comparing this cost with the average market value of crude oil, which, after deducting royalties, was $1.36, shows a clear loss of 81 cents per barrel. These figures, even allowing for widest variation, reveal a most unhealthy situation. Certainly this is not the sound economic basis on which a great industry should depend for its raw material.

These are considerations we are apt to lose sight of when we fill up the flivver with 15-cent gasoline or, as technologists, study the chemical engineering problems of oil refining. Nevertheless they lie at the very basis of our industrial enterprises. In the case of oil shale, where the industry is yet in a formative stage, it is especially important that we make sure that sound economics as well as good technology forms the foundation for future development.

A Chemist Who Has Served Mankind

The Celebration of the Eightieth Birthday of the Father of "Pure Food" Recalls a Long Career of Service

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Dr. Harvey W. Wiley

BACK in 1871, when Dr. Charles E. Monroe was an instructor at Harvard, there appeared in Cambridge a tall young man with a black beard. Although there were misgivings on the part of the faculty, who apparently believed that a pirate had wandered from the Spanish Main, nevertheless the tall young man enrolled as Harvey Washington Wiley. Graduated in 1873 with a bachelor's degree, though he already held a medical degree, Dr. Wiley soon became professor of chemistry at Purdue University and remained there till he was called to Washington as chief chemist of the Department of Agriculture in 1883. Here Dr. Wiley made a world-wide reputation in his fight for pure food which finally resulted in the Pure Food and Drug Act of 1906. Naturally he made many enemies too—so bitter that their main idea in life became a personal vengeance on Dr. Wiley.

But his fight for pure food has been won not only by legislation and government inspection of food products but by the development of a consciousness on the part of the people of the country for clean food.

In Washington last week in connection with a meeting of agricultural chemists a banquet was tendered to Dr. Wiley in honor of his eightieth birthday. Many distinguished scientists were present. W. W. Skinner, of the Bureau of Chemistry, acted as toastmaster and introduced B. B. Ross, who told of Dr. Wiley's part in founding the American Association of Agricultural Chemists. C. A. Browne, director of the Bureau of Chemistry, reviewed Dr. Wiley's work as head of that institution. Finally Dr. Wiley was asked to shake hands with some old friends, and four disreputable characters were ushered into the room: Ben Zoate, Sally Cylate, C. Tar Dye and Sac Charin. Dr. Wiley as usual rose to the occasion, remarking that long and intimate association had only intensified his hate for each of them. He bade them good-by forever with the exhortation to lead a life in fields where each could be useful and not harmful.

Dr. Wiley has been a genial and leading figure in the field of chemistry for nearly half a century. Had he been merely a pioneer, and most of his generation of chemists were pioneers, he would have deserved the respect of his colleagues, but Wiley is more than a pioneer, he is a crusader. In the biggest sense of the word his was a crusade and his leadership, aggressive, courageous and strong, has made the crusade successful. Nearly every one of the 110,000,000 people in this country benefits daily from Wiley's work for clean food. The timeliness of the work also deserves comment. Imagine a national distribution of foodstuffs that present-day methods of transportation and advertising have made possible without the safeguarding that Wiley created.

Chem. & Met. adds its felicitations to the great volume of acclaim that has poured in on Dr. Wiley on his eightieth birthday. Still strong, vigorous, genial, he has yet many years in which to serve this country, to educate its people in correct and healthful diet.

Economic Problems in Oil-Shale Development

More Important Than Purely Technical Considerations Is the Fundamental Economic Basis on Which a Great Oil-Shale Industry Will Some Day Be Established—Here Are Some of the Problems That Await Solution by the Engineer and Technologist

By Sidney D. Kirkpatrick
Assistant Editor, *Chem. & Met.*

The real oil-shale problem of today is an economic one. We can mine, crush and retort the shale and then refine and sell its products—but until the whole operation can be carried on at a profit, there is no economic justification for an oil-shale industry.

SOME TIME AGO this statement was made to me by a successful business man who had devoted 10 of his 50-odd years to oil shale and had contributed a considerable personal fortune toward its commercial development. During the past year I have had this view confirmed many times in conversations and as the result of first-hand study of our shale resources. Without in any way minimizing the importance of the many technical problems involved in oil-shale development, it may be said with certainty that economic considerations are fundamental to any progress in establishing an industry. Unfortunately, the whole problem involves economic questions on which, at the present stage of development, sufficiently accurate and comprehensive information is lacking. To call attention to, rather than to answer, these questions is the purpose of the present discussion.

A Picturesque Notch in the Oil-Shale Cliffs Near Grand Valley, Colorado.

THE NEED FOR SHALE OIL

In its formative stage any large industrial enterprise faces two economic questions, viz.: Is there a certain need for the product? Can it be produced and sold at a profit? In the case of oil shale it is not at all difficult to show that there is a large potential—if not actual—need for the product. The most cursory study of the relations between the domestic consumption and production of petroleum products is sufficient to reveal a condition that warrants serious consideration of all possible means of providing for our future supply of liquid fuels. At the moment shale oil, the products of coal carbonization and, perhaps, alcohol look to be the most promising substitutes or supplementary materials. Yet so many other factors are involved in our fuel problem that no one can predict how or when these outside sources will be called into play. Some help, to be sure, is to be had from the comprehensive statistics of the petroleum industry, but these figures alone give us only a very inadequate and unsatisfactory answer to the problem.

Since 1914 the domestic consumption of crude petroleum has increased almost 300 per cent, or from 261,000,000 bbl. in 1914 to 711,000,000 bbl. in 1923. Domestic production, as the result of intensive drilling and the discovery of new fields, has increased in much the same proportion, yet only three times in 10 years (in 1914, 1915 and 1923) has it been sufficient to supply domestic requirements. The difference between consumption and production, which in 1920 reached a maximum of 88,000,000 bbl., has been met by greatly increasing importations of crude oil.

In 1923 the development of the three great flush pools of California, combined with the increased output of the mid-continent field, was sufficient once again to

push production ahead of consumption and to permit a small recession in imports. This was peculiarly fortunate in one sense, for it was about that time that the Mexican wells, which since 1917 had been the principal foreign source of supply, began to show indications of a falling output. The oil refiners have now turned attention to South America, Russia, Turkey and other foreign countries and for the past few years a world-wide search for oil has been in progress.

Tables I and II compiled by the American Petroleum Institute show another significant characteristic of the petroleum industry. It will be observed that with the exception of the striking persistence of the Eastern field, the output of the major districts has varied widely. Sudden increases and equally sharp recessions show how the different pools come and go and how the producing industry shifts from one center to another. This is a contributing element of an instability that brings periods of overproduction and demoralized market conditions sharply on the heels of threatened shortage and high prices. Furthermore, it stands out in striking contrast with a shale-oil industry once the latter is established. With its resources definitely evaluated and production under easy control of the operator, the stability of the industry is assured.

Table I—Petroleum Production of Major Divisions in 1890, 1900, 1910, 1920 and 1923

	1890	1900	1910	1920	1923
Eastern *	45,145,838	59,054,383	67,289,802	44,464,000	39,821,000
Mid-Continent	1,200	917,225	59,217,582	250,111,000	343,928,000
Gulf Coast	54	....	9,680,465	27,682,000	31,561,000
Rocky Mountain	368,842	322,835	355,224	17,282,000	46,663,000
California	307,360	4,324,484	73,010,560	103,377,000	263,729,000
Others	278	1,602	3,615	13,000	....
Totals	45,823,572	63,620,529	209,557,248	442,729,000	725,702,000

* Appalachian, Lima, Ohio, Indiana, and Illinois.

Table II—United States Production, Imports, Consumption and Stocks of Crude Petroleum, 1921-23

	1923, Bbl.	1922, Bbl.	1921, Bbl.
Production	725,702,000	557,531,000	472,183,000
Imports	82,015,000	127,308,000	125,364,000
Exports	17,400,000	10,153,000	8,940,000
Stocks (Dec. 31)	333,053,000	264,578,000	185,623,000
Indicated U. S. consumption of domestic and imported oil	710,739,000	592,442,000	420,462,000

The only logical view of the petroleum industry, however, is from the study of its long-time trends. Most important of these are the rapid and tremendous increase in consumption and the intensive effort to meet this increase by developing new domestic production and new foreign supplies. Obviously, these sources are not inexhaustible and their accelerated exploitation merely brings nearer the inevitable shortage that will make it necessary to find other solutions for our fuel problem.

In addition to increased draught on foreign countries there will undoubtedly be greater conservation and better utilization of our domestic resources.[1] The saturated oil sands of the production fields as well as in deposits in various parts of the country may be forced to yield their oil content. The use of higher boiling distillates (even of fuel oil[2]) in our automobiles may come about through changes in engine design.

As the greater efficiency of the Diesel type of engine is appreciated a larger proportion of our coal will be carbonized either in byproduct ovens of the present type, or, what is more likely, by the low-temperature process. The latter gives a larger yield of liquid products as well as a more satisfactory fuel for many industrial operations. Alcohol, already used for motor fuels in the tropics and in some of the European countries, may be developed on a sufficient scale to care for a portion of the demand. The fact remains, however, that both coal byproducts and alcohol are themselves of limited supply unless radically new sources and methods are developed. If all of the 545,000,000 tons of bituminous coal mined during 1923 were carbonized and the benzol fraction used as motor fuel, it would supply but a sixth of our annual gasoline consumption. In 1923 we produced 122,402,850 proof gal. of alcohol, compared with a gasoline consumption of almost 7 billion gallons.

But of the different materials that may be looked upon as substitutes for petroleum products, shale oil is generally held to be the most logical. It is most similar in character to petroleum and the tremendous resources of oil shale constitute an oil reserve ample to supply domestic consumption for many decades. The extent of these resources and their potential oil yields were discussed in some detail in the preceding article of this series. (See *Chem. & Met.*, pp. 610-615, Oct. 20, 1924.)

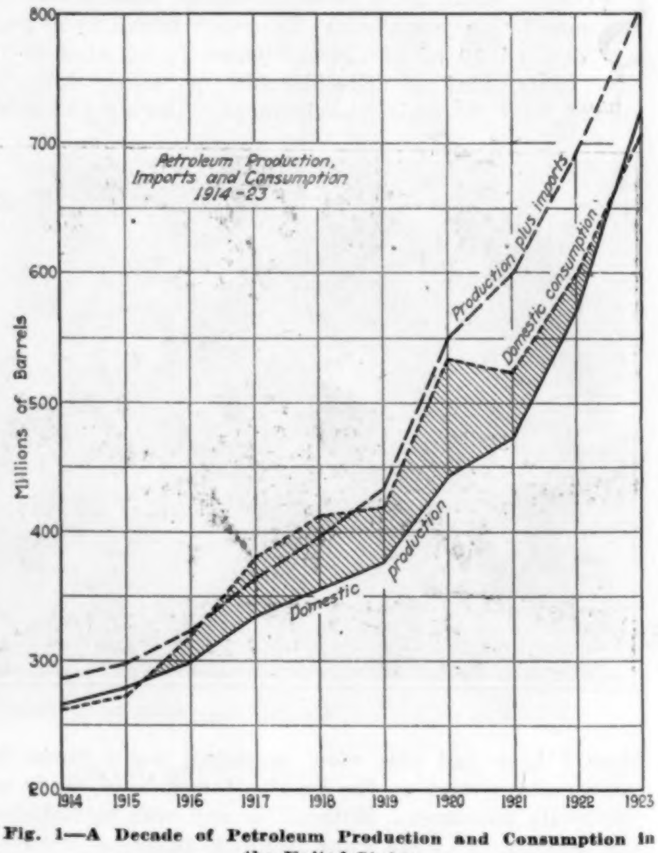

Fig. 1—A Decade of Petroleum Production and Consumption in the United States

The shaded portions show the years and the extent to which consumption exceeded the domestic production. Only three times —in 1914, 1915 and 1923—has it been unnecessary for us to rely for a portion of our supply on importations of foreign oil.

Economic Problems

Before the potential need of today is translated into an actual demand for shale oil and its products, development on a large scale is essential. To establish the definite economic basis for the industry—to draw a balance sheet of its credits and debits—requires more ac-

[1]Some of these means have been suggested by W. A. Hamor (*Chem. & Met.*, Sept. 8, 1920, vol. 23, pp. 425-435, and Aug. 31, 1921, vol. 25, p. 441.)

[2]Heavy oil engines have already been successfully applied to automobiles and trucks by the French firm Peugeot and by the Benz Engine Co., Mannheim, Germany, according to *Oil Engine Power*, September, 1924, p. 494.

curate and comprehensive figures than arm-chair estimates or prospective costs based on small-scale experimentation.

To date only a single operator—the Catlin Shale Products Co., of Elko, Nev.—has carried on continuous production to an extent sufficient to give even semi-accurate estimates of the various costs involved and values derivable. Unfortunately this operator is working under conditions considerably different than those which prevail in nine-tenths of the oil-shale area, so that his cost figures—even if they were available—would not be of general application.

We cannot afford to lose sight of the fact that when production is finally established on a scale comparable with present petroleum operations, oil shale will take a place among the largest industries of the country. To yield a quantity of shale oil equivalent to our present crude oil production would require a mining industry larger than the existing coal industry. Merely to supply the equivalent of the average annual difference between petroleum production and consumption during the years 1916 to 1922 (48,000,000 bbl.) would call for 130 establishments capable of handling 1,000 tons of shale every day of the year. To take care of the entire domestic consumption of petroleum in 1923 would have required 1,900 shale plants of 1,000 tons daily capacity, or 19,000 plants the size of the largest which has yet reached continuous operation for an extended period in this country.

In addition to its size the future shale-oil industry will have a number of other characteristics of economic interest. The disturbing element of instability resulting from the fact that the petroleum industry must shift from one locality to another as its available resources are exhausted will not be a factor in oil-shale development. For this reason plants, housing facilities, etc., can be built on a more permanent basis. And to take advantage of the wider margin of profit in refining there will undoubtedly be a tendency to establish refineries at the principal retorting centers, which of necessity must be as near as possible to the deposits. This will emphasize the problem of water supply, already an acute issue when one considers the large quantities required for domestic and industrial purposes by the mining and retorting branches of the industry.

Handling a large tonnage, perhaps at a small margin of profit, makes the future industry comparable to the mining and production of copper from the low-grade ores of Utah. Here success is possible only because of the large-scale continuous operations and the use of highly efficient methods and equipment.

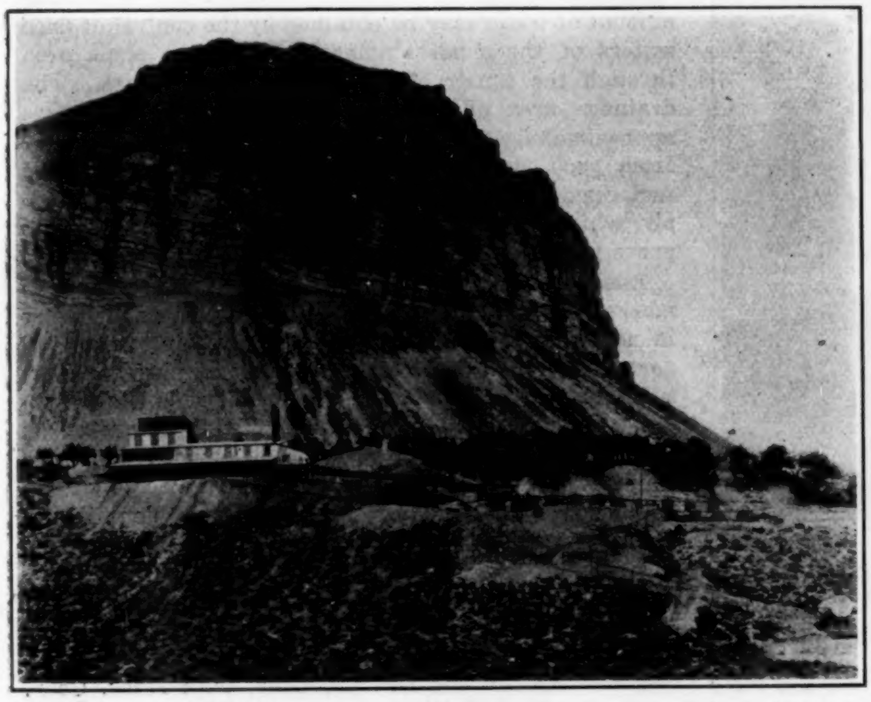

Fig. 2—An Oil-Shale Plant With Its Mountain of Ore Reserves

This shows the plant of the Index Shale Products Co. near De Beque, Colo. In the background is Mount Blaine, from which it is intended to mine the oil shale from outcrops several hundred feet above the plant site. On the knoll at the right is the camp with office and housing facilities for employees.

Factors Determining Value of Oil Shale

Several of the factors that determine the comparative value of oil-shale properties are of economic significance in relation to the industry as a whole. Principal among these are: (1) The quantity of shale available and its yield of oil and byproducts; (2) the physical character of the shale as it affects the mining, crushing and retorting; (3) the character of the shale oil and its refinability; (4) access to transportation and available market; (5) water supply; (6) labor supply; (7) topographical features of the deposits as they bear on plant location, dumping facilities for the spent shale, housing of workmen, sanitation and other conditions.

From an economic viewpoint these factors are not of equal interest and furthermore several of them—such, for example, as those referring to the physical and chemical characteristics of the shale and its products—will be discussed in greater detail in a subsequent article. The question of quantity and yields of the various products is, however, of more pertinent interest at this time.

The Scottish oil-shale industry yields refined products in the following proportion, according to the United States Bureau of Mines Bulletin 210:[3] Naphtha (gasoline) end point 450 deg. F., 9.9 per cent; illuminating and burning oils, 24.8 per cent; gas and fuel oils, 24.4 per cent; lubricating oils, 6.6 per cent; paraffine wax, 9.5, and still coke, 2.0 per cent. Loss amounted to 22.8

[3]Oil Shale—An Historical, Technical and Economic Study. By Martin J. Gavin. U. S. Bureau of Mines Bull. 210, p. 85. Revised edition, published April, 1924. In the writer's opinion the most comprehensive survey that has yet been made of American oil shale.—S. D. K.

per cent. In addition a ton of Scottish shale will yield approximately 35 lb. of ammonium sulphate, this product being especially desirable, because under existing conditions in Great Britain it can be marketed at an attractive profit. Although nitrogen is present in many American oil shales in equal or even larger amounts, it is questionable whether or not ammonium sulphate can be economically recovered, since, at the moment, our large production from byproduct coke plants appears to offer serious competition. On the other hand, economic conditions may warrant our giving attention to nitrogen recovery, at least during certain stages of the development. The first American oil-shale operations will probably concentrate attention on relatively few products, perhaps on gasoline, fuel and lubricating oils and paraffine wax. Some plans call for the marketing of only gasoline and a flotation oil—a use for shale oil which appears to have interesting possibilities, although the market is not at all comparable in size with that for fuel and lubricating oils. Of the hundreds of

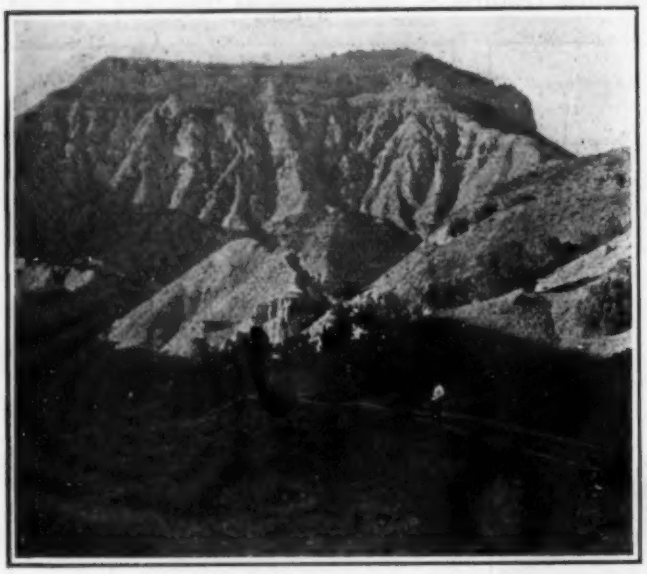

Fig. 3—Mt. Logan
A towering mass of oil shale, overlooking the valley of the Grand River of the Colorado and easily accessible to water and transportation.

byproducts proposed by various oil-shale enthusiasts—ranging all the way from helium to platinum and lamp chimneys to hair oil—carbon black from uncondensed gases seems at the moment to be most practicable. On the other hand, it appears desirable that in the early stages of development the American oil-shale industry should produce only those products for which there is a certain and active demand. After production is once established, it will be ample time to give attention to byproducts that offer economic possibilities.

Before erecting his retorting and refining plant, the oil-shale operator will definitely establish his ore reserves. This can readily be done by surface sampling of the oil-shale outcrops and by core drilling. For a plant of 1,000 tons daily capacity, an ore reserve of perhaps 20,000,000 tons—enough for 50 years operation—might be considered adequate. With an average depth of 35 ft. of workable shale yielding 42 gal. of oil per ton, 300 acres would be ample. Most of those now interested in oil-shale development hold the view, however, that at least a section (640 acres) is desirable. In addition to the reserve there would need be a site for the retorting and refining plant, which of necessity must include adequate ground for disposing of the spent shale as well as land on which to house the plant's employees. A 1,000-ton plant would have to contend with almost a half million cubic yards of waste shale a year. This would weather and pack down to some extent in time, but the disposal is nevertheless a real problem. Housing facilities for the families of perhaps 100 to 150 miners and 50 or more retort and refining operatives would be required. The water supply for domestic and industrial purposes in such a plant would be in the neighborhood of 150,000 to 200,000 gal. per day. This alone is a serious problem, especially in certain of the Western shale districts, where there is little rainfall and the streams are small and often dry a large part of the year. In most of these localities the water originating in the mountains and top country has been appropriated for irrigation purposes by the farmers of the valley. Some shale investors have purchased farm land in order merely to obtain control of water rights. Others plan to pump water from the rivers, or bring it down through long pipe lines from the mountains. It is probable also that a certain amount of water may be obtained by the control of flood waters of the small streams crossing the shale area through the construction of storage reservoirs. The drainage area of Roan Creek and its tributaries is approximately 500 square miles and the flood water from such an area is, of course, considerable. The fact remains, however, that the problem of water supply, while not insurmountable, is nevertheless likely to prove serious and its solution costly.

Adequate transportation facilities for carrying to market the products of the plant as well as bringing in necessary supplies and equipment will prove an important factor in developing an oil-shale industry. Fortunately, most of the shales of the Colorado-Utah-Wyoming district are already fairly well taken care of by two transcontinental railroads—the Denver, Rio Grande & Western on the south, and the Union Pacific on the north. Elko, the center of the Nevada deposits, is reached by both the Western Pacific and the Southern Pacific railroads. The great Uintah Basin in Utah, however, is now served only by a narrow-gage mountain railroad with grades so steep that Shay locomotives are required. The Uintah Railroad, 60 miles in length, connects Watson and Dragon, Utah, with Mack, Colo., on the D., R. G. & W. Railroad. Although considerable expansion and building of spurs and branch lines for plant connections will, of course, be necessary, it would seem that the transportation problem is not a serious one, for the foundation for such a service is already laid.

With the exception of Denver and Salt Lake City, there are no large consuming markets for petroleum products immediately at hand. In its earlier stages of development the industry will doubtless supply only local demand, but as it progresses it will gradually extend its market to the larger industrial centers of the East. The freight on this long haul is a factor that may react to some extent in favor of the development of the leaner but more accessible shale deposits of Kentucky, Ohio, Indiana and other states of the so-called Eastern field.

Pipe-line transportation of crude shale oil from a number of retorting plants to a large central refinery favorably situated, as far as transportation and markets are concerned, has been proposed, but may offer certain technical difficulties. Unlike most crude petroleum

oils, the shale oils, because of higher paraffine content, are comparatively viscous. Auxiliary heating at frequent intervals and insulated pipe lines will probably be required.

Some Cost Estimates

Earlier in this article it was pointed out that at the present stage of oil-shale development it is not possible to obtain accurate or even roughly accurate data on the cost of producing shale oil on a commercial scale in this country. This is due not alone to the fact that, with perhaps one exception, present operations are on a frankly experimental basis. Physical conditions as they affect the quantity and quality of the shale and its ease of mining and retorting will vary widely among the different deposits. Furthermore, shale products have not yet been marketed on a sufficient scale to demonstrate their ultimate economic value. These difficulties, however, have not discouraged the promoters and others who have given us cost estimates on practically every operation and product of the future industry. Some of these represent conscientious efforts based on pioneer experimentation; others are of the arm-chair variety.

Without wishing to give credence to gossip or to lend authority to estimates based on performance claims that cannot be substantiated, it may be worth while considering a few figures that have been suggested. Some idea may thus be gained of their order of magnitude, as well as the wide range among different estimates.

In the matter of mining, we find opinion divided between those who would use underground methods such as are employed in coal mining and those who believe that open-cut quarrying methods will be applicable. The majority, to be sure, are included in the first group, and it should be pointed out that what development and experimental work has been done in this country has been based on tunnels and drifts entering the outcrop. As we should naturally expect, there is a wide difference in cost estimates by the two methods. The quarrying group holds to figures in the neighborhood of 25 to 45 cents per ton, as compared with 75 cents to $1.50 per ton for the underground method. The estimate of $1.50 is that of the chairman of the committee on mining of the oil-shale section of the American Mining Congress, as reported at the Milwaukee meeting, September, 1923. It was based on a contemplated operation of 10,000 tons per day. Two companies that have operated experimental plants intermittently at De Beque, Colo., during the past few years claim to be able to mine shale yielding 60 gal. of oil per ton at a cost of 91 and 96 cents per ton. An engineer who has given study to mining conditions on deposits near Green River, Wyo., gives us an estimate of $1 per ton, declaring that 60 cents is not improbable in large-scale operations by stoping methods, using mechanical shovels for handling the broken shale.

That mining costs are the most important factor in the total cost of producing shale oil is indicated by the fact that in Scotland in 1919 mining costs accounted for 52.97 per cent of the total cost of producing the refined products. Retorting amounted to 18.56 per cent, refining 15.10 per cent, and ammonium sulphate production to 13.57 per cent.[4]

[4]These figures, from Bureau of Mines Bull. 210, p. 96, do not include fixed, general and overhead costs of retorting.

It is difficult to compare the costs of crushing, because requirements of the retorting processes vary from ¼ in. or finer in the case of some of the horizontal retorts to lumps the size of a man's fist used in some of the vertical types. The estimates for the two Colorado plants previously referred to are 6 cents and 12 cents per ton. Day[5] gives an elaborate table of cost estimates for various degrees of crushing at various tonnages. For a 1,000-ton plant these range from 24 cents for ¼-in. down to 6 cents per ton for 2-in. material.

Likewise in the case of retorting there is no reason to expect uniformity of costs, since the processes proposed often have little in common. It is not surprising, therefore, to find one inventor claiming a cost of retorting of 9 cents per ton, while the "balance sheet" of another plant a short distance away shows a cost of 34 cents per ton for the same operation. Neither includes overhead or depreciation charges. Refining costs are even more hazy, for the methods used are far from commercial and cannot be compared, because of the different products obtained and the varied extent to which refining is carried.

Shale oil, according to these figures, might cost anywhere from 87 cents to $3 a bbl. While it is true that most of those interested in oil shale hold present costs to be in the neighborhood of $1.50 a bbl., it is rather significant that since the fall in the price of crude oil a number of oil-shale promoters have revised their cost estimates—downward.

The foregoing is sufficient, I believe, to show the futility of attempting to reduce to a definite cost schedule our present knowledge of oil-shale development. It should not, however, be discouraging to those who are now engaged in the process of accumulating the fundamental knowledge and experience upon which the proper development of our great oil-shale resources must be based. It is certain that the future industry will make most progress if built on a foundation of combined technology and sound economics.

Editor's Note. The third article of this series will deal with the technical problems of oil-shale development. It will be published in a subsequent issue of *Chem. & Met.*

British Sulphuric Acid Production

Data on the production of sulphuric acid in Great Britain are given in the Oct. 4, 1924, issue of the *Chemical Age* (London) as follows:

	1913	1921-22	1922-23	1923-24
Sulphuric acid made, as 70 per cent H_2SO_4, tons	1,500,000	985,000	1,225,000	1,272,000
Per cent plant capacity used	85	48	62	63
Raw materials:				
Pyrites, tons	800,000	358,000	365,000	350,000
Spent oxide, tons	110,000	129,000	157,000	148,000
Sulphur, tons	3,000	16,000	45,000	66,000

Changes in raw materials are brought out in the following tabulation:

Year	Acid (Including Oleum) made, as 100 Per Cent H_2SO_4 Tons	Per Cent Made From — Pyrites — Imported	Domestic	Spent Oxide	Sulphur	Zinc Fumes
1914	1,082,000	88.5	0.45	10.6	0.3	0.15
1917	1,382,000	79.9	1.7	11.0	8.1	0.30
1918	1,130,000	79.4	1.6	11.2	7.4	0.40
1919	883,000	80.3	0.8	15.9	1.8	1.2
1920	1,053,000	80.4	0.9	16.7	1.2	0.8
1921	560,000	71.0	1.0	24.0	3.6	0.4
1922	817,000	61.8	1.1	25.5	9.6	2.0
1923	873,000	51.1	1.1	23.2	21.5	3.1
1924 (to June)	485,000	53.0	1.2	21.0	22.1	2.7

[5]Day, David T. (editor), "Handbook of the Petroleum Industry," Vol. I, p. 861. John Wiley & Sons.

Relations of Thermal Quality to Value of Fuel Gases

When Used in Efficient Appliances the Value Per B.t.u. Is Practically Independent of the Kind of Gas Burned

By C. F. Carrier
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GAS QUALITY may involve several factors for special purposes, but from the energy standpoint there can be eliminated from discussion all such as do not concern its ability to perform work. This reservation practically narrows the line of thought to the one factor of heating value.

Commercial fuel gases are in use over a range in which the maximum heating value per unit volume is approximately ten times that of the minimum heating value per unit volume—that is, natural gas and blast-furnace gas. Between these extremes are other gases of varying heating value. The question as to the actual relative values of these gases of different heating value has frequently been raised. Is their value correctly measured by simple proportion, directly to the B.t.u. per cu.ft., or not?

It is proposed to answer this question by a simple discussion of the relative ability of the various gases to perform work. If the work done per unit cost is equal, then any incidental variations in quality cease to be of practical interest, as long as heating value is all that is required. Conversion to mechanical work is not under consideration. If the ability of the heat units in various gases to perform purely thermal work is affected by variations in thermal quality, then the reasons therefor should be more clearly understood and the limitations reduced if possible to some simple numerical basis.

Table I—Thermal Properties of Fuel Gases

	B.t.u. Per Cu.Ft.	*Thermal Factor	†Combustion Factor
Methane	959	1.00	11.00
Carbon monoxide	341	2.81	8.43
Hydrogen	292	3.28	9.84
50% hydrogen, 50% CO	316.5	3.03	9.09
⅓ CO, ⅔ nitrogen	113.7	8.43	14.05

* Number of cu.ft. to give the same number of B.t.u. as 1 cu.ft. of methane, 959 B.t.u.

† Number of cu.ft. of products of combustion produced in the development of 959 B.t.u. by combustion with air assumed to be 1 vol. O plus 4 vol. N, based on the volumetric reactions as follows:

$$CH_4 + 2(O_2 + 4N_2) = CO_2 + 2H_2O + 8N_2$$
$$1.00\,(1 + 2 + 8) = 11.00$$
$$CO + 0.5(O_2 + 4N_2) = CO_2 + 2N_2$$
$$2.81\,(1 + 2) = 8.43$$
$$H_2 + 0.5(O_2 + 4N_2) = H_2O + 2N_2$$
$$3.28\,(1 + 2) = 9.84$$
$$0.5\,CO\ 0.5\,H_2 + 0.5(O_2 + 4N_2) = 0.5\,CO_2 + 0.5\,H_2O + 2N_2$$
$$3.03\,(0.5 + 0.5 + 2) = 9.09$$
$$\tfrac{1}{3}\,CO\ \tfrac{2}{3}\,N_2 + \frac{0.5}{3}(O_2 + 4N_2) = \tfrac{1}{3}\,CO_2 + \frac{4}{3}N_2$$
$$8.43\left(\tfrac{1}{3} + \frac{4}{3}\right) = 14.05$$

Combustion of gases for commercial purposes involves practically only three combustible gases, methane, hydrogen and carbon monoxide. The relative amounts of other gases involved are so small that they may be ignored for this discussion. The commercial fuel gases all consist of varied mixtures, the main part of whose heating value is derived from one or more of these three. Natural gas is essentially methane, water gas essentially carbon monoxide and hydrogen, and generator gas essentially carbon monoxide with varying proportions hydrogen and methane. The mathematical consideration of combustion becomes complicated when each constituent is considered separately in terms of the exact percentage composition of any special mixture, but the problem can be greatly simplified by treating each of the pure gases separately, as limiting cases, and comparing with type mixtures representing the commercial gases. A mixture of 50 per cent each of carbon monoxide and hydrogen has the water-gas type and a mixture of one-third carbon monoxide and two-thirds nitrogen the generator gas type. These hypothetical fuel gases have the thermal properties indicated in Table I.

The figures in the table called "thermal factor" are an arithmetical expression of the relative volumes of the five gases that are required to give the same number of B.t.u., in this case methane being unity. If the heating value, in practice, is dependent only on the relative heat value of the gas, then these thermal factors are a correct expression of the relative value of the gases, but it is to be noted that the numbers under "Combustion Factor" do not bear the same relation to one another. While the same number of B.t.u. have been developed by combustion in all five cases, there is a substantial variation in the volume of the products of combustion.

Measuring the Performance of Gases

It is obvious that the heating effect cannot be identical with such differences in this factor, therefore it becomes essential to determine how serious these differences are and under what conditions they become more or less serious factors. This is most easily reduced to a concrete basis by computing a simple relative measure of the work that can be performed by the same number of B.t.u. in the form of the five different gases. Work is measured in terms of energy converted in attaining the desired result, and this is further limited by the fact that no useful work can be done until conditions are such that the conversion is in the desired form. With these thermodynamic laws in mind, it may be found that for some purposes the substitution of one gas for another on a basis of relative heat value or constant B.t.u. may have little significance, while under other conditions the relative commercial values may be seriously altered.

Two great classes of heat work may be assumed, (a) boiling processes where the waste gases escape at about 400 deg. F. and (b) furnace processes where the waste gases escape at temperatures of the order of 1,800 deg. F. For comparative purposes, the computation may be simplified by considering all heat below the temperature of the exit gases as waste, and above that temperature as potentially useful. The relationship is shown in the table:

Gas	Volume Containing Equal B.t.u.	Loss of B.t.u. at 400 Deg. F.	Per Cent of Useful Heat	Loss of B.t.u. at 1800 Deg. F.	Per Cent of Useful Heat
Methane	1.00	90.56	90.6	471.54	50.8
Carbon monoxide	2.81	72.61	92.4	393.62	59.0
Hydrogen	3.28	80.85	91.6	422.13	56.0
CO & H	3.03	76.50	92.0	407.20	57.5
CO & N	8.43	115.94	87.9	601.72	37.3

The figures for B.t.u. in the table represent the total heat, at the given temperature, carried away by the combustion gases in the liberation of a total of 959 B.t.u., by the combustion of the necessary equivalent volume of the various gases. The values have been

computed on the basis of the following thermal capacities per cu.ft.:

Temp., Deg. F.	Nitrogen	Water Vapor	Carbon Dioxide
400	7.71	9.23	10.42
1,800	37.03	54.64	66.02

Inspection of the tabulated results permits drawing a number of purely empirical conclusions. It is entirely logical to find that the percentage of heat lost is directly related to the relative volume of combustion gases derived from the liberation of equal amounts of heat as expressed in B.t.u. But until the fact is reduced to approximately correct figures, it is not so obvious that the effective heating value of methane per B.t.u. is less than that of any other common combustible gas. Carbon monoxide is the most effective heating gas per B.t.u. that is commercially available. A very pure "blue gas" could be produced slightly better than pure hydrogen in effective heating value, and it is only when diluted with nitrogen that the carbon monoxide-hydrogen mixtures become less effective than methane. Even a dilution of carbon monoxide with 66⅔ per cent of nitrogen reduces the heat effectiveness per B.t.u. only the small margin of 2.7 when the waste gases escape at 400 deg. F., but it becomes increasingly serious with rising temperatures, the margin being 13.5 when the waste gases are at 1,800 deg. F.

Equitable Rates for Gas

For domestic purposes, gas rates based on equivalent B.t.u. basis would be perfectly equitable, for the difference in effective heating value per B.t.u. at 400 deg. F. is so small that it could not be detected on the gas bills. The only limitation seems to be a gas which can be made to ignite and burn, for lean gas of only 113.7 B.t.u. per cu.ft. is only 2.7 per cent less effective per heat unit, from the pure heating standpoint, than 959 B.t.u. methane.

For furnace use, the effective heating value of the undiluted combustible gases is practically the same regardless of the nature of the gas, the proportions of the mixture and the working temperature, within the limits found in practice. The introduction of inert constituents apparently seriously alters the situation, and so it does if the waste gases are allowed to escape at the high working temperatures, but in practice heat regeneration is applied. Assume 70 per cent recovery in the regenerators. With methane, the percentage of useful heat becomes 85.2 when 70 per cent of the lost 49.2 per cent at 1,800 deg. F. is regenerated and with the lean gas, only one-third combustible, the useful heat is raised to 81.2 per cent.

General Conclusion Drawn

From the above, the general conclusion can be drawn that within the limits of all commercial gases, so far as simple heating effect is concerned, the B.t.u. standard is an equitable basis for determining gas value.

Other factors may of course have a bearing on the question of price for special gases for special purposes, but when the heat is developed with reasonably efficient appliances, the value per B.t.u. is practically independent of the kind of combustible gas, the proportions of the mixture and the working temperature. Hence, except under special circumstances, that commercial gas which can be produced at the lowest cost per B.t.u. will be the most economical gas to use for heating purposes.

Measuring Metal's Resistance to Shock

A Study of Impact Tests on Monel Metal and New Methods of Obtaining Figures Indicative of the Toughness of the Metal Tested

By R. G. Waltenberg

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NOTCHED bar impact tests are becoming of increasing importance and the type of specimen to use in impact tests has been the subject of much discussion, consequently the determination of impact properties which are dependent on the material and not primarily on the type of specimen tested appears to be a solution of the problem of impact testing.

Dr. Paul Fillunger published an article "On Notched Bar Impact Tests" in *Testing*, vol. 1, p. 23, 1924, in which are defined impact properties which are characteristic properties of the material. He considered the energy required to produce fracture in a notched bar impact specimen as consisting of two parts, the energy to produce deformation and the energy required to fracture the specimen. The energy to produce deformation is expressed by the formula,

$$A_1 = \delta bhy$$

where b = the width, h = the height of the cross-section to be fractured, y = the eccentricity, i.e., the distance of the center of gravity of the area of fracture from the axis of the bore of the notch, δ = a characteristic property of the material representing its resistance to deformation. The energy to produce fracture is expressed by the formula

$$A_2 = 2\omega bh$$

where b and h are the dimensions of the fracture and 2ω is a characteristic property of the material representing its resistance to fracture. Then the total energy consumed in a notched bar impact test is

$$A = A_1 + A_2 = \delta bhy + 2\omega bh$$

The "notch toughness," e, is found by dividing the total energy by the area of the cross-section, then

$$e = \delta y + 2\omega$$

It is seen that the notch toughness, e, is not a characteristic property of the material but is dependent upon the eccentricity, y. δ and 2ω are characteristic properties of the material and may be obtained by determining the notch toughness for several eccentricities.

Dr. Fillunger determined these properties on a 0.31 per cent carbon steel (80,000 lb. per sq.in. tensile strength) by using seven different notches and the impact properties as determined by the different tests were in fair agreement. He obtained δ = 10.2 m.kg. per cu.cm., and 2ω = 4.6 m.kg. per sq.cm. for this steel.

The author has shown in a previous article[1] that, in so far as our present knowledge extends, the energy absorbed in fracturing Monel metal in impact is greater than that required to fracture any other material; therefore it was thought desirable to determine the impact properties of Monel metal as defined by Dr. Fillunger.

Determinations of the notch toughness were made on

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[1]"Note on Notched Bar Impact Tests and Toughness of Monel Metal," *Chem. & Met.*, vol. 25, p. 322.

Even a completely corrosion-resistant metal would be of no value if its physical properties were not such that the metal would be capable of withstanding the mechanical abuse to which it must be subjected in industrial use. A property of the utmost importance to the designer and user of equipment is the "shock toughness" of the metal. The notched bar impact test provides a measure of this property.

The test if properly made consists of more than the simple fracture of an arbitrary test specimen. If the "shock toughness" is to be learned in figures that are truly indicative, the method of testing must be studied and the relationship between energy consumed and the form of the specimen analyzed.

R. G. Waltenberg provides here a clear conception of the meaning of the figures that are used to denote "shock toughness."

Monel metal specimens cut from hot-rolled $\frac{3}{8}$-in. square bar which had the following tensile properties: Yield point, 49,600 lb. per sq.in.; breaking strength, 94,600 lb. per sq.in.; elongation, 54 per cent, and reduction of area, 72 per cent.

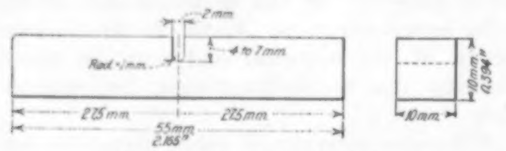
The specimens were tested in a Charpy impact machine. The type of specimen is shown in the figure herewith.

To obtain various values of eccentricity, y, the notch was cut to four different depths, 4, 5, 6 and 7 mm. Five specimens of each notch were tested.

The following table gives the results of the tests:

Depth of Notch, cm.	Eccentricity y cm.	Energy of Impact (average) m.kg.	ft. lb.	Notch Toughness e m.kg. per sq.cm.	ft.lb. per sq.in.
0.4	0.40	15.61 ± 0.14	113	26.0	1,210
0.5	0.35	11.57 ± 0.30	84	23.1	1,080
0.6	0.30	7.85 ± 0.06	57	19.6	910
0.7	0.25	5.16 ± 0.03	37	17.2	800

It will be noted that the energy absorbed as expressed in meter kilograms in the table has been given to more significant figures than the accuracy of notched bar impact tests would usually justify. The average deviation from the mean has also been given in order



Type of Specimen Tested

that the reader may have some idea of the agreement between individual tests. The reason why these values of the energy absorbed have been given is that if we consider the values of the notch toughness as significant to only two figures when expressed in meter kilograms per centimeter cube we find by substituting such values of e and y in the equation $e = \delta y + 2\omega$ there is obtained 60 m.kg. per cu.cm. for δ and 2 m.kg. per sq.cm. for 2ω for all combinations of e and y. Ordinarily one would suppose that such an agreement indicated quite accurate determinations of these two properties, but this is not true. If we solve for δ and 2ω using values of e and y given in the table above we get values of δ ranging from 48 to 70 m.kg. per cu.cm. and for 2ω -1.4 to $+5.2$ m.kg. per sq.cm. A better valuation of these results may be obtained by combining only those results which were obtained on notches which varied at least 2 mm. in depth. Then we get values of δ ranging from 58.7 to 64 m.kg. per sq.cm. and for 2ω 0.4 to 2.5 m.kg. per sq.cm. with average values of $\delta = 61$ m.kg. per sq.cm. and $2\omega = 1.8$ m.kg. per sq.cm.

For the present it may be considered that the impact properties of Monel metal can be represented by $\delta = 60$ m.kg. per cu.cm. and $2\omega = 1.8$ m.kg. per sq.cm. These values may be compared with those obtained on other metals by Dr. Fillunger. He gives the following:

	δ	2ω
Different steels, some heat-treated	1.0 to 22.2	2.4 to 6.6
Wrought iron	19.0	almost 0
Copper sheet	10 to 13	1.75 to 2.15
Cast aluminum	0.15	0.35
Tool steel, hardened Quality I	0.65	0.58
Quality II	0.17	0.64

It can be seen that the resistance of Monel metal to failure by impact as determined by this method compares favorably with any of the materials which, so far, have been tested.

Those properties of a material which represent its resistance to rupture in impact are usually expressed by stating the energy required to rupture a specimen in impact. For any material this energy varies with different types of specimens, therefore a method whereby the resistance of a material to rupture in impact may be determined and expressed independent of the type of specimen would be an addition to our methods of testing. It remains to be seen whether this method proposed by Dr. Fillunger can be applied so as to give characteristic properties which may be considered in selecting materials for a specific purpose.

Solving the Fertilizer Problem for France

With the numerous synthetic ammonia projects, Alsatian potash, and the development of the Tunisian and Moroccan phosphate deposits, France bids fair to become substantially independent of foreign sources of fertilizer materials.

Four synthetic ammonia processes are involved. The Claude process is already in operation in conjunction with a battery of byproduct coke ovens in the north. Another important plant that will employ the Georges Claude process is the Société Ammonia in projection at the Anzin coal mines in the north of France. The Kuhlmann and Solvay interests are notably concerned therein. The Casale process is being worked under a monopoly for France by the Campagnie d'Alais, Froges et Camargue in its plant at Saint Aubin and in connection with a group of coal producers at Lens in north France as well. At the Toulouse powder works the Haber process is being installed.

A modification of the Haber process developed by Fauser in Italy, where the Montecatini Co. has the rights to the process, is to be operated in France by the Société des Phosphates Tunisiennes. The latter company has acquired the hydro-electric plant of the Norwegian-American Abrasive Co. at Gedre, in the Hautes-Pyrenees, and in conjunction with the Montecatini Co. has begun the development of an additional 45,000 hp., of which 25,000 hp. will be available in 18 months.

French consumption of nitrogen compounds amounts to about 85,000 tons per year, whereas Germany requires annually about 250,000 tons.

Economic Factors in Roofing Manufacture

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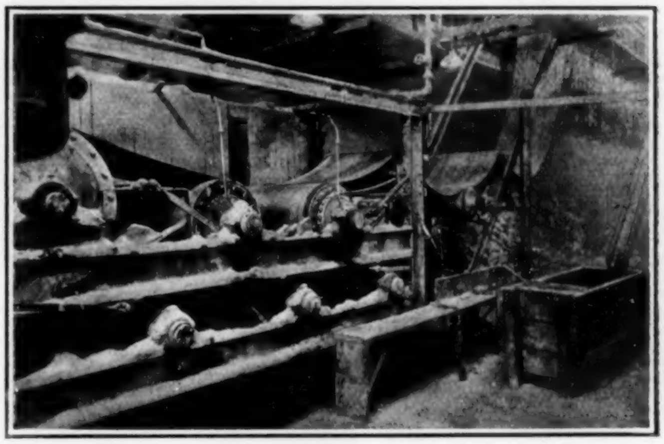
Editor's Note—Other articles published in this journal have covered the technical and engineering aspects of the manufacture of asphaltic roofing. These, however, are not the only aspects of this, or, for that matter, of any other industry, that must be considered by the manufacturer who purposes to establish a plant. The present article brings out these other aspects and presents data that cannot fail to be helpful to the roofing manufacturer and suggestive to others about to embark upon a new venture.

PROBABLY no branch of industry provides more opportunity for studies in raw material procurement, manufacturing facilities and finished product distribution than does prepared or surfaced roofing, which is made principally from rag felt, asphalt and granular slate. This is not a localized industry. It is most successfully conducted when its national or international scope is fully recognized. While in its application and selling ramifications it extends into the building industry in the remotest corners of the country, in its production it associates and links several of the world's most important industries while combining diverse raw materials.

The waste rag material originates principally at population centers. Petroleum originates principally in the Southwest and Mexico. Slate that has proper color and will granulate properly is found only in some rather isolated locations, in Vermont, Pennsylvania, Michigan, California and the South. Markets are everywhere and are extending, particularly in suburban and rural districts.

One accordingly finds rag-collecting depots and the felt mills located where abundant water and labor are obtainable, at suitable shipping points near the sources of rag supply, particularly in the Eastern Central states. The saturating, coating and shingle plants, on the other hand, it seems best to locate more with relation to the distributed market, at various good shipping and labor points throughout the country. Roofing felt can be shipped in concentrated bulk, in rolls, protected against the absorption of moisture. Roofing asphalt can also be shipped readily in tank cars provided with coils for the use of steam heating when unloading in cold weather.

This method of handling the business assists in solving the storage problem, particularly with relation to the intermediate products, and also the warehousing problem for finished goods and the labor problem; and more readily permits the market preferences of certain localities being catered to and their needs met by immediate delivery. The price of rags varies considerably



Slate Surface Machine

throughout the year, so that large rag storage adjacent to felt mills is essential in successful conduct of this business.

The oil refinery should be located on the main channels of transportation from Mexico and the Southwest to the market center in the Central states, so as readily to distribute asphalt to the saturating and coating plants and at the same time be able to distribute competitively to other markets byproducts that are not used in the roofing industry. To insure continuous operation, considerable storage capacity for crude at the refinery is essential. Storage for roofing asphalt is best provided at the saturating plants; and this is materially assisted by the capacity of the tank cars in transit.

Owing to the differing and varying requirements of the markets supplied by individual roofing plants and the economy of performing the granulating operation on as large a scale as possible, the slate-granulating plants are best located at the quarries or mines. It is comparatively simple to carry the rock from the ground through the granulating plant into box cars and deliver it to protected bins at the coating plants without allowing it to become exposed to moisture.

Making Granulated Slate

In the production of granulated slate it is usually preferable to mine the rock rather than quarry it, so as to insure its being perfectly dry. Here is a crushing problem in which fine grinding is not desired. The granules must be uniform. Tests on samples of Vermont granules indicated that by weight 66 per cent of the product goes through 10 mesh and on to 20, 23 per cent goes through 20 mesh and on to 30, and 11 per cent goes through 30 mesh. A flow sheet is provided in Fig. 1, for a Michigan plant having a capacity of 240 tons of granules per 8-hour day.

The plant took an average of 450 kw. for the 8-hour day at a cost of approximately 2½c. per kw.-hr., making a power cost of approximately 40c. per ton. The material would be shipped at approximately or possibly somewhat less than $1 per ton, including labor and overhead. A somewhat detailed construction cost for this plant is given in the accompanying table.

The felt mill and the manufacture of felt are very similar to the paper mill and the manufacture of paper, where cylinder type machines are employed. The class of labor is the same and, in general, the machinery employed is the same as in the board mill. The felt machine usually employed produces a roll 72 in. wide, which

Construction Cost of a Granulated Slate Plant

Railroad siding, 800 ft. at $50 per ft.	$4,000
Clearing 5 acres of land at $200 per acre	1,000
Construction 4-mile transmission, erection transformers	8,000
Cutt ng away rock from hill for mill site at $50 per yd.	1,000
Well—50 ft. deep for drills, buildings and heating boiler	500
Telephone installation	100
Machinery complete per flow sheet	60,000
Motors and starters, 600 hp. at $25 per hp.	15,000
Installation of machinery and motors	8,000
Mill building, including lighting system	10,000
Combination office, supply room, first aid and home	4,000
Equipment for combination office	2,000
Machine shop building	1,500
Machine shop equipment	5,000
Change house and equipment for workmen	5,000
Heating system and plant	3,000
Concrete foundations	2,000
Powder storage shed	600
Storage bins, material and labor	6,000
Transformer station	3,300
Plans, designs, specifications, engineering and construction supervision	10,000
Total	$150,000

is slit into two of 36 in. each. The flow sheet of a felt mill is shown in Fig. 2.

The usual felt mill is exceedingly inefficient in the use of power and steam. Felt mills are usually self-contained—that is, they generate the power which is required, and largely as a byproduct in obtaining the steam that is required in drying. This is a problem that is susceptible of being worked out very nicely through the application of proper engineering principles. Where quantity of heat, as in this case largely, is the deciding factor, there is no advantage in generating at or reducing to 30 lb. pressure. The exhaust from the average non-condensing engine or turbine is just as good when the steam is used near where generated. There is, in fact, but 3½ per cent more heat in steam at 150 lb. than at 5 lb. gage.

The layout of the roofing mill is of utmost importance from a production point of view. Here the problem is to maintain and deliver a water-free felt to the saturating machine, saturate it and coat it with asphalt and an even layer of slate granules at high temperature, cool it and wind it into rolls or cut it into shingles for shipment. The total amount of power employed is small, being in the neighborhood of 50 or 60 hp. for a continuous saturating, coating and single cutting unit. About 35 hp. is required for the saturating and coating machines and cooling rolls, 10 hp. for the cutters and 10 hp. for the driers when used in advance of the saturating machine, and for the beginning rolls. Whereas

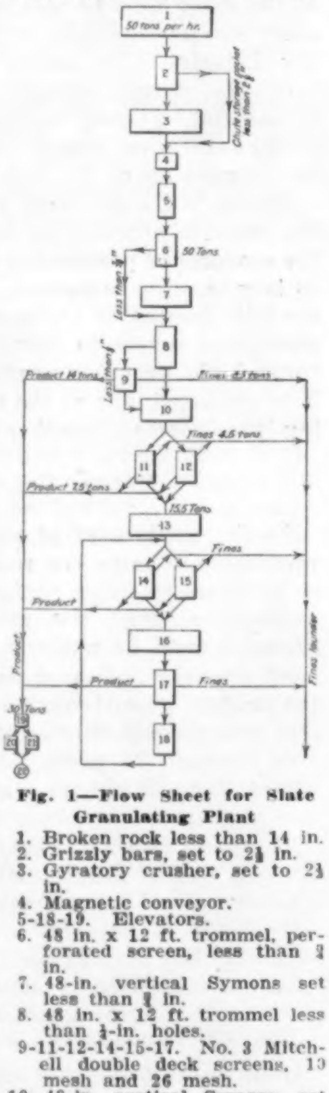


Fig. 1—Flow Sheet for Slate Granulating Plant

1. Broken rock less than 14 in.
2. Grizzly bars, set to 2½ in.
3. Gyratory crusher, set to 2½ in.
4. Magnetic conveyor.
5-18-19. Elevators.
6. 48 in. x 12 ft. trommel, perforated screen, less than ⅜ in.
7. 48-in. vertical Symons set less than ⅜ in.
8. 48 in. x 12 ft. trommel less than ⅛-in. holes.
9-11-12-14-15-17. No. 3 Mitchell double deck screens, 10 mesh and 26 mesh.
10. 48-in. vertical Symons, set less than ⅛ in.
13. 42x16-in. rolls, set to less than ⅛ in.
16. 42x16-in. rolls, set to less than $\frac{1}{16}$ in.
20-21. Storage bins.
22. Loading spout.

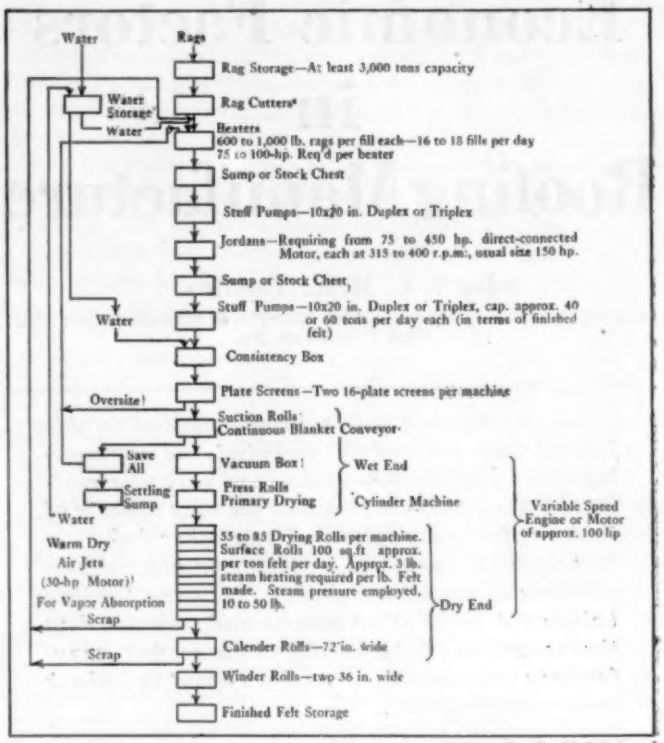


Fig. 2—Flow Sheet for Roofing Felt Mill

in the felt mill cylinders filled with steam are used to dry out moisture, here the usual function of the cylinders is to cool and harden the saturated and coated felt before it is rolled or cut into shingles, and for such purpose they are supplied with a constant stream of cool water. The hot water discharge goes to the boiler room or the beater room. Usually, however, the cylinder

Operating Expense—Felt Mill

Week Ending 3/20/20

176 Employees—398 Tons Felt Produced

		Total	Per Ton
	Productive labor:		
1.	Sorting and cutting	$702.90	$1.77
2.	Beater men	1,233.22	3.10
3.	Trucking—beater room	145.20	.36
4.	Machine tenders	578.63	1.45
5.	Cleaning and oiling	56.65	.14
6.	Testing and winding rolls	180.58	.45
7.	Receiving rags	400.72	1.01
8.	Receiving paper	34.10	.09
9.	Receiving coal	72.74	.18
		$3,404.74	$8.55
	Non-productive labor:		
10.	Repairs, rag-cutting machines	115.50	$0.29
11.	Grinders, cutting knives	31.24	.08
12.	Repairs to paper beaters	7.62	.02
13.	Repairs to rag beaters	111.16	.28
14.	Repairs to chests	67.60	.17
15.	Repairs to jordans	1.66	.005
16.	Repairs to sundry equipment	113.72	.29
17.	Repairs to No. 1 machine	58.97	.15
18.	Repairs to No. 2 machine	51.91	.13
19.	Repairs to No. 3 machine	42.38	.11
20.	Repairs to machine room equipment	12.18	.03
21.	Engineer and firemen	431.50	1.08
22.	Repairs to boilers	5.94	.015
23.	Repairs to stokers	5.54	.015
24.	Repairs to boiler house equipment	273.82	.684
25.	Repairs to pumps	90.54	.23
26.	Repairs to electrical equipment	58.08	.14
27.	Repairs to motors	27.08	.07
28.	Repairs to water tower	6.30	.02
29.	Repairs to locomotive crane	63.05	.16
30.	Repairs to machine shop equipment	4.56	.01
31.	Repairs to machine rooms	148.80	.37
32.	Shipping labor	151.55	.38
33.	Watchmen and janitors	57.30	.14
34.	Drivers	127.63	.32
35.	Miscellaneous building repair	21.40	.05
36.	Miscellaneous expense	51.59	.13
		$2,135.62	$5.37
	Grand total labor	$5,540.36	$13.92
	Cost of rags at platform		78.00
	Cost of coal, 2 tons per ton of felt at approx. $4		8.00
	Total cost of felt per ton		$100.00

Refinery Cost Estimates

	Real estate			$50,250.00
3	55,000-bbl. tanks	$25,000 each,	$12,000 const.	111,000.00
3	12,000-bbl. tanks	9,500 each,	3,400 const.	37,700.00
5	5,000-bbl.. Tanks	4,900 each,	1,650 const.	32,750.00
2	2,000-bbl. tanks	3,100 each,	950 const.	8,100.00
2	1,000-bbl. tanks	2,000 each,	600 const.	5,200.00
1	60 x 10 x 4 ft. O.T. tanks	2,200 each,	600 const.	2,800.00
1	6 x 4 x 4 ft. O.T. tanks			250.00
1	4 ft. dia., 6 ft. high x ½ in.			350.00
1	90 x 40 x 12 ft. O.T. tank	17,000 each,	4,000	21,000.00
2	30 x 15 x 12 ft. O.T. tank	2,000 each,	600	5,200.00
1	Separator	4,000 each,	1,200	5,200.00
6	Stills, 42 x 14 ft. 6 in.	7,000 each,	2,100	54,600.00
3	30 x 5 ft,	3,000 each,	750	11,250.00
1	Water tower, 50,000 gal.			12,000.00
3	350-hp. B. & W. boilers, $28 per hp., $15,000 each			45,000.00
1	2,000-hp. Swartout boiler feed heater, $1,750, const. 422			2,172.00
2	Foster superheaters, 10,000-lb. capacity, 4,700-420, 2000			8,240.00
26	Hammel fuel oil burners, $40 each			1,040.00
1	Hammel fuel oil set, 6 x 4 x 6			1,850.00
1	W. S. compound pot valve plunger pump, 14 x 25 x 10 x 24			10,500.00
4	W. S. piston pot valve pumps, 14 x 10½ x 18 in., $2,500			10,000.00
2	W. S. piston box pumps, B.L., 14 x 10½ x 18 in., $2,950			5,900.00
3	W.S. piston box pumps, B.L., 9 x 7 x 15, $2,200			6,600.00
2	W.S. plunger pot valve pumps. B. L., 10x7x18, $2,400			4,800.00
1	Buffalo Underwriters fire pump, B.L., 18 x 10 x 12			2,090.00
2	Box, B.L., 7½ x 6 x 10, $550			1,100.00
3	Kinney pumps, motor size 12-8-8 strainer, $2,662			7,986 00
2	Motor-driven water pumps			1,200.00
2	Motor-driven geared oil pumps for trap			1,200.00
6	3 in. Fisher governors, $65			135.00
2	No. 4 P.H. & F.M. Roots gas exhausters			3,246.00
1	3-ton ice plant			
1	400 ft. wharf and approach			54,000.00
	Buildings complete			73,600.00
	Still and condenser foundations - brickwork			38,850.00
	3,900-ft. switch track, $6 per ft			23,400.00
2	10 in. water wells			4,700.00
1	River water filter plant			4,450.00
	Lumber - form and scaffolding			1,850.00
	Pipe			75,454.20
	Pipe fittings and pipe covering			44,463.76
46	"I" beams—15 lb., 40 ft. long, 77,280 lb., 5c			38,640.00
	Steel stairways - walkways			1,052.00
	710 ft. Cyclone 7 ft. fence			1,313.50
2	200-kw. generators, turbine			22,600.00
1	Oil trap, 50 x 20 ft			6,724.00
	Electric light and motor installation			11,797.00
2	Air compressors			10,000.00
2	Radial brick stacks, 125 ft. x 90 in. = $8,724			17,448.00
	Switch engine			14,000.00
	Machine shop and equipment, tools complete			11,438.42
	Electric welding outfits, tools complete			2,460.00
	Foamite installation			48,790.00
	Local phone system			3,500.00
12	Houses and bunk house and dining room			48,000.00
748	Piles and driving			11,168.00
	Concrete mixer with gasolene engine			1,300.00
	Team mules			600.00
	Wagon, plow, scrapers and mowing machine			1,280.00
2	Concrete tanks, 30 x 60 x 4 ft., water			4,875.00
	Rope. blocks, shackels, shovels, picks, wheelbarrows, etc			2,000.00
2	Trucks, one 5-ton and one 2-ton White			7,300.00
	Automobile, Ford			580.00
	Laboratory testing equipment			1,840.00
	Steam hoisting engine			4,000.00
	Roads, sidewalks, sewers, ditching, etc			810.00
	Cement sidewalks, 4,380 sq.ft., 45c			2,171.00
	Material and labor for equipment not shown			10,000.00

Employees Necessary to Operate Asphalt Refinery

1	Refining superintendent	$12.00 per day	$12.00
1	Foreman	9.00 per day	9.00
3	Asphalt stillmen	8.00 per day	24.00
3	Still firemen	5.00 per day	15.00
3	Boiler firemen	5.00 per day	15.00
1	Boiler tender and washer	5.00 per day	5.00
3	Oil testers	7.00 per day	21.00
3	Pumpers	6.50 per day	19.50
3	Gages and tank car loaders	6.50 per day	19.50
1	Tank car inspector and repair man	5.00 per day	5.00
1	Electrician	8.00 per day	8.00
3	Electrician engineers to operate light plant	6.00 per day	18.00
1	Day watchman	5.00 per day	5.00
2	Night watchmen	4.00 per day	8.00
1	Machinist	8.00 per day	8.00
1	Blacksmith	6.50 per day	6.50
1	Pipe fitter	6.50 per day	6.50
1	Welder	8.00 per day	8.00
6	Helpers	4.00 per day	24.00
2	Truck drivers	4.00 per day	8.00
1	Teamster	3.00 per day	3.00
10	Laborers	3.00 per day	30.00
			$278.00
	Accountant	$200.00	
	Timekeeper, per month	150.00	
	Storekeeper	150.00	
	Shipping clerk	200.00	

coolers are supplemented by or often largely supplanted by stick type looper coolers.

The largest machine output is obtained by entirely separating the saturating and coating processes. Splices may be made after felt has been saturated. Spraying of saturant on felt is being considered, although the usual way is to run the felt through a tank

Production Report Four-Machine Roofing Factory Week Ending Oct. 2, 1920

Smooth Roofings:	Firsts	Seconds	Thirds	Hrs.	Sgle.	Dble.
Silex lt.	1,059	50	12	6–51	155	...
Silex med.	100	8	2	–45	133	...
Silex hvy.	45	2	1	–30	90	...
Higrade med.	76	...	2	–31	147	
Higrade hvy.	1,374	10	10	8–35	160	...
Asphalt med.	122	17	5	–45	163	...
Asphalt 47 ft. med. 201 rls.	234	...	...	1–30	156	...
Asphalt hvy.	282	5	...	1–43	164	...
Built-up.	861	...	3	5–13	165	...
	4,153	92	35	26–23	...	...
Slate Surface:						
Blue Mt. std.	2,431	103	31	10–13	...	238
Wm. Gray std.	1,224	11	3	5–45	...	213
Green slate std.	4	56	50	.....	...	...
Red slate std.	2,263	23	15	8–59	...	252
Green slate jbo.	12	6	...	.....	...	...
Style P–B.M. L.W.	422	65	6	5–35	76	...
"B" Stock B.M. 56 rls.	65	...	...	–31	126	...
Blue Mtn. std.	1,726	30	10	13–10	131	...
Style O red L.W.	621	32	5	6–18	99	...
Red slate 47 ft., 306 rls.	358	10	1	2–31	143	...
Stype P– L.W. red.	810	99	7	8–10	99	...
	9,936	435	128	61–12	...	...

Shingles:	Firsts	Seconds						
L green.	1,063	18¼	2,444¼	42¼	...	10–50	...	226
R green.	922½	18½	2,121½	42¾	...	10–26	...	203
G green std.	325¼	7¾	869	20	...	3–36	...	241
G red std.	456¼	2½	1,223	6¼	...	5–02	...	243
G green jbo.	462	...	1,062	...	...	4–19	...	246
E green std.	430¼	1½	1,204	4	...	4–48	...	...
	3,659¾	48¾	8,924	114½	...	39–01	...	...
Total of smooth rfg. squares			4,153	92	35	26–23	...	...
Total slate surface squares			9,936	435	128	61–12	...	...
Total shingles fsts	3,659¾	...	.....	...	...	.....	...	...
Total shingles scds.	48¾		8,924	114½	...	39–01	...	...
			23,013	641½	163	126–36	...	...
Percentage of seconds and thirds			23,817	804	.033			
1 and 3 Adv. per hr. single mach.			8,155	62–38	.130			
2 and 4 Adv. per hr. double mach.			14,858	63–58	.232			

Labor cost per square productive—$0.123.
Labor cost direct and indirect, per square—$0.245.

Mach.	Hours	Produced	Adv. Fsts. per Hr.	Misc. Delays Dwn.	No. Ord.
No. 1	26–23	4,153	157	3–37	30
No. 2	40–22	9,635	239	3–08	10
No. 3	36–15	4,002	110	6–15	10
No. 4	23–36	5,223	221	16–44	20

of saturant maintained at temperature by heating coils. Saturant temperature employed varies from 420 deg. F. down to 350 deg. F. The latter is best practice, in which also two saturating machines are used for one coating machine. As a coating temperature of 360 to 370 deg. F. is maintained by steam coils in the tank cars, high-pressure steam, above 150 lb., is necessary. A preferred layout would include:

1. A looper for dry felt.
2. A simple saturating section and reel winder for saturating felt.
3. A conveyor so that a series of reels may be carried and set up in place for the coating section.
4. A coating section with another looper.
5. A simple set of coating rolls, probably two, and means for distributing slate evenly upon the coating.
6. A stick looper with squeeze rolls installed in place for imbedding the slate.

How Asphalt Is Obtained

In the saturation process, an asphalt soft enough to impregnate the felt without excess is used, and hard high melting point material is used as a coating, to protect against abrasion and weathering. The saturant is obtained by the distilling of crude petroleum and the coating is obtained from the impregnating of asphalt, by a further process of oxidization, either by a vacuum system or a blow system at high temperatures. It is spoken of as blown asphalt. This operation may be performed at the refinery and the blown asphalt shipped in drums. Coating obtained and shipped in this manner from an uncontrolled source has been about 50 per cent more expensive than saturant. However, a number of roofing mills have found it preferable to avoid the

Report of Labor Distribution Four-Machine Roofing Factory, Week Ending Oct. 2, 1920

Productive

Acct. No.	Name of Account	
1	Still	$387.66
2	Mach. style R & G std	392.81
	Mach. style "L"	130.64
	Mach. style G– std	146.11
	Mach. style "R"	172.04
	Mach. style P– L.W	91.88
	Mach. style G– Jbo	30.69
	Mach. style "E"	41.83
	Mach. style O–L.W	50.14
	Mach. style "B" stock	3.17
	Mach. style Silex-lt	37.58
	Mach. style Silex-med	5.07
	Mach. style Silex-hvy	2.04
	Mach. style Higrade-med	2.55
	Mach. style Higrade-hvy	25.48
	Mach. style Built-up	23.38
	Mach. style Asph. med	10.36
	Mach. style Asph. hvy	10.98
3	Work order	6.83
4	Work order	24.67
5	Work order	1.58
6	Trucking machine	24.73
7	Crane operating	32.03
8	Cutting style D	.....
9	Cutting style B	10.80
10	Bundling style E	9.96
11	Bundling style G	77.64
12	Bundling style L	45.76
13	Bundling style R	45.54
14	8-in. stripes	3.00
15	Packing	334.40
16	Shipping	553.52
		2,954.87
	Less work orders	33.08
		2,921.79
		2,918.32
	Total chargeable to rfg. prod	$5,840.11

Non-Productive

Acct. No.	Name of Account	
17	Power and boiler H.L	$321.01
18	Repairs to pr. h. equip	.98
19	Repairs to steam lines	......
20	Repairs to boilers	23.58
21	Repairs to mach. No. 1	69.43
22	Repairs to mach. No. 2	109.37
23	Repairs to mach. No. 3	64.35
24	Repairs to mach. No. 4	104.21
25	Repairs to stills	35.88
26	Repairs to machine shop	......
27	Repairs to motors	22.30
28	Repairs to still pumps	7.66
29	Repairs to buildings	87.47
30	Repairs to sundry equipment	144.72
31	Repairs to elec. equip	23.40
32	Work order	27.35
33	Chauffeurs' salaries	166.45
34	Repairs and renewals A trks	13.00
35	Work order	25.18
36	Work order	23.60
37	Drivers' salaries	27.00
38	Repairs, hrs. and wag. equipment	6.80
39	Work order	12.38
40	Superintendence	......
41	Laboratory salaries	23.00
42	Miscellaneous labor	1,193.45
43	Receiving labor	416.50
44	Yard labor	16.18
45	Sample labor	21.58
46	Office salaries	20.00
47	Work order	123.27
48	Work order No.	15.94
49	Work order No.	52.90
50	Work order No. K.C	1.20
51	Work order No.	7.05
		3,207.19
	Less work orders	288.87
		2,918 32

expense of drums by shipping all asphalt as saturant and blowing the necessary coating at the roofing mill, making as large use as possible of tank cars.

Out on the Pacific coast in 1920 a roofing mill paid $13 per ton for asphaltum for saturation f.o.b. Richmond in tank cars and $20.50 or $23 per ton for petrolastic cement, depending upon the penetration. This asphaltum was mixed with a certain percentage of Texas asphalt at $29 per ton delivered, to make coating.

The industry practically justifies a refinery devoted primarily to its own requirements. In addition to the large tonnages of saturating and coating asphalt demanded, there is a large field for refinery distillate products in the manufacture of mastic cushions for roofing tile, roof-repairing cements and cold roof paints. These products are manufactured with very small labor cost. A Pacific coast plant during 1920 with only five men in the paint factory and with suitable equipment in less than 4,000 sq.ft. of space had a monthly capacity of 12,000 gal. black, 5,000 gal. red, 5,000 gal. green and 8,000 gal. brown roofing paint, 15,000 gal. shingle stains, 8,000 gal. concrete paint and 40 tons of elastic cement.

The crude petroleum refinery, which is shown for the roofing industry in Fig. 3, was designed for a location on the lower Mississippi. It is laid out for the receipt and storage of crude from tankers and for the rail shipment of refinery products. The industrial layout includes a model felt and roofing mill for local Southern and export trade. Production and costs for this refinery are shown by the accompanying table.

These are based upon detailed first-cost and labor analyses. Those figures are supplied in the accompanying table, as, together with the diagram of plant layout, they furnish a better and more accurate idea, and more

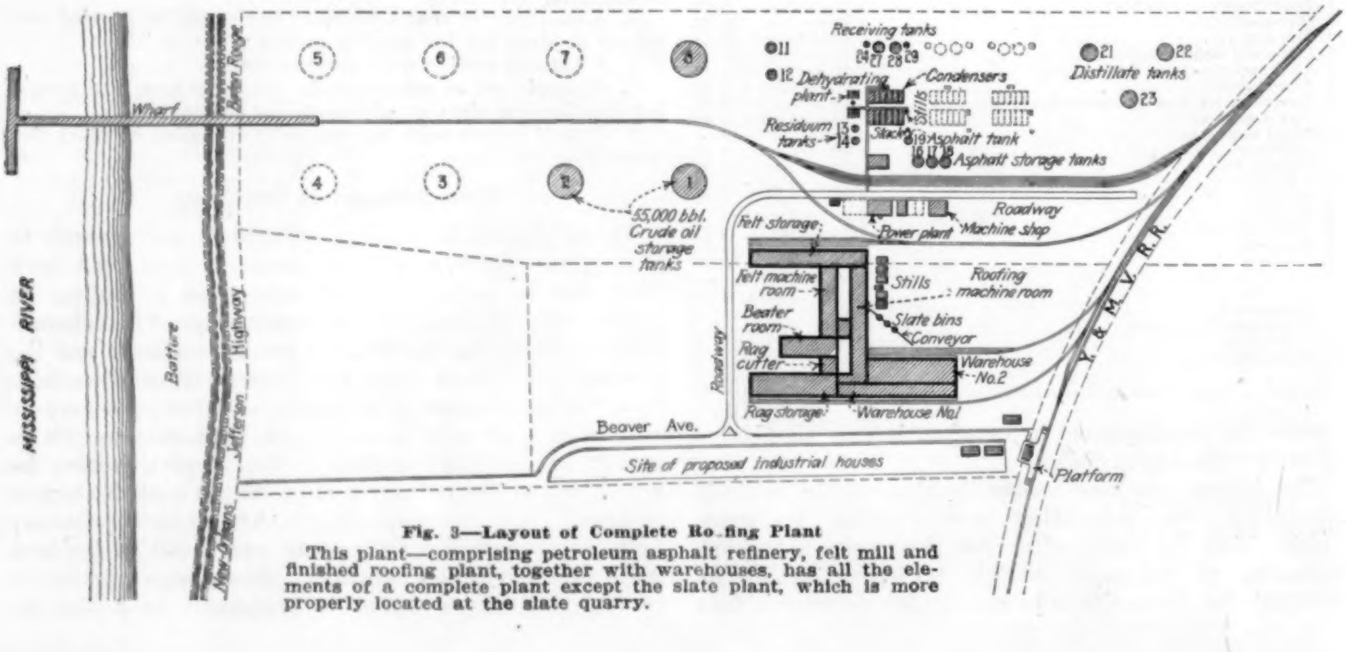


Fig. 3—Layout of Complete Roofing Plant

This plant—comprising petroleum asphalt refinery, felt mill and finished roofing plant, together with warehouses, has all the elements of a complete plant except the slate plant, which is more properly located at the slate quarry.

Refinery Production and Costs

Production—4,000 bbl. crude per day—1,460,000 bbl. per year—365 days	
Asphalt—78 per cent—1,138,800 bbl.—207,312 tons.	
Asphalt cost at $18 × 207,312	$3,731,616
Crude naphtha—4 per cent—58,400 bbl. at 15c. per gal.	387,920
Gas oil—8 per cent—116,800 bbl. at 10c. per gal.	490,560
Fuel oil—7 per cent—102,200 bbl. at $1.80	183,960
Total sales	$4,774,056
Costs:	
Interest—$1,100,000 at 7 per cent	$77,000
Depreciation—$1,100,000 at 5 per cent	55,000
Crude oil—at 80 cents—1,460,000 bbl.	1,168,000
Crude oil freight—at $1 per bbl.	1,460,000
Taxes—20 mills on 50 per cent valuation	11,000
Manufacturing—Labor—$300 per day	109,500
Fuel—43,800 bbl.	78,840
Loss—3 per cent—43,800 bbl.	78,840
Material costs—maintenance	24,000
Total costs	$3,066,180
Profit	$1,707,876

briefly, than pages of description of what is involved in such a plant.

Roofing Mill Operating Costs

Detailed costs are also provided on a four-machine mill covering a week's period of operation. There are several things noteworthy from a consideration of this report that are perhaps typical of such a plant and indicative of results that are sometimes obtained actually as compared to what it appears might be obtained. The operation was one full shift for 6 days per week. Notable points are that for 70 machine-hours the machines were down because of no working orders; for nearly one-fifth of the remaining available time the machines did not deliver output owing to miscellaneous delays. The machines actually worked in production a total of only approximately 126½ machine-hours during the week. They produced in that time a total of 23,817 squares of smooth and slate-surfaced roofings, 9,038½ squares of which went into singles. While producing, they produced at the rate of only 188 squares per machine-hour and at a total labor cost per square of 24½ cents.

Congress of French Producers of Resinous Products

The fourteenth congress of the Federation des Gemmeurs Résineurs du Sudouest de France met the last of September at Magescq, a forest village of the Landes, the chief source of the production of resinous products in France. The association comprises fourteen producing syndicates, in all 40,000 members dispersed through the departments of the Landes, de la Gironde and Lot-et-Garonne in southwest France.

Various measures were discussed and put to vote for the purpose of improving the situation of the industry. Among other measures were those of the establishment of further means of communication through the forests of the various districts and the organization of fire protection on a scale which has hitherto been unthought of in France, a new system of measuring the turpentine and resin drawn from the trees and a special controlled form of barrel in which French resin should be henceforth marketed.

Finally it was voted that the national government, apart from the work which it was doing in the state forests, should be asked to co-operate in the clearing off of underbrush in communal and private forests which the local proprietors are not always willing or able to do, thereby suppressing fire risks, which are yearly growing greater in France.

New Zealand's Fossil Gums

Kauri

An Account of the Production and Use of This Important Article of Commerce Is the Second Article on Fossil Gums

By W. M. Myers

Assistant Mineral Technologist, New Brunswick Station, Bureau of Mines

THE KAURI tree flourishes in New Zealand, but the deposits of fossilized gum are found only in localities where several generations of the trees have grown old, fallen and decayed, leaving the gum which they have produced. The gum has gradually been buried to shallow depths beneath the accumulations of soil and partly decayed organic matter. In the low flat lands these deposits are swampy, and continued vegetable growth has converted them into peat swamps. The deposits are not old from a geological standpoint; it is doubtful if their age exceeds the period of time that would be required for several generations of the trees to grow old and decay, possibly a few thousand years.

The digging of kauri from these deposits was carried on in an irregular manner by the early settlers and the native Maoris, but when their value was realized and an active market was developed, they were mined on a large scale. This required the importation of foreign labor, and in 1896 there was a large influx of Austrians, who have since constituted an important laboring class in the kauri industry. Kauri is mined on lands privately owned, and also on lands owned by the state upon the payment of a nominal fee, which has permitted the exploration of large areas.

How Kauri Is Procured

In the early stages of the industry large quantities of kauri were found directly on the surface or at very shallow depths, where it could be easily excavated. When this material was exhausted, more systematic search for possible gum-bearing deposits became necessary and the diggers began to look around for fragments of partly decayed kauri wood in the ground or for the last vestiges of the stumps of the kauri trees, around which large amounts of gum were often found. Gum below the surface of the ground was located with gum-spears, thin steel rods, up to 16 ft. in length, often fastened to an ordinary shovel handle for convenience in use. By prodding in the soil with this spear an experienced operator can distinguish lumps of gum by the feel and impact. Masses of kauri weighing 75 lb. have been recovered, and the existence of gum-bearing areas located by its use. Small excavations were made in favorable localities and any gum encountered collected, after which the operation was abandoned. This system of "pot-holing" left the ground in such condition that it was practically worthless for any subsequent use. The smaller pieces of gum were recovered by agitating the gum-bearing soil in a metal tub with water. This tub was provided with a perforated bottom that permitted the disintegrated soil and fine material to escape. The small pieces of gum and the fragments of wood and soil associated with it were removed from the tub and

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dried, and the gum separated by winnowing. This crude apparatus was improved by the addition of several screens of different sized mesh, which permitted the recovery of a cleaner and better classified product.

The gum recovered was sorted and the larger pieces more or less completely scraped to remove the surface material which had suffered some alteration from burial in the soil. The marketing of kauri was largely in the hands of local shopkeepers, who in many instances had made advances to the diggers on his season's production. The supply in the hands of the shopkeepers was collected by the agents of the exporters, and the annual production gradually found its way to Auckland, where it was graded and prepared for export. The production of kauri was largely in the hands of individuals operating on a small scale in a very primitive manner. This resulted in an irregular production of gum that was poorly prepared for the market, and due to the lack of any uniform system of grading required further expensive rehandling and classification before export.

Effect of the War on the Kauri Industry

In 1914 approximately 6,000 men were employed in gum digging. The outbreak of hostilities was followed by a business paralysis that caused such a severe slump in the gum industry that practically all these men were thrown out of employment. Distress among the employees and their families became so acute that relief by governmental agencies became imperative. The state assumed active control of the industry and immediately advanced cash to the diggers on the security of the supplies of gum they had on hand. Systematic digging operations were instituted on lands owned by the Crown, which furnished employment to a large number of men. These operations, known as "face diggings," were carried on in localities that had been irregularly worked by pot-holing for years. Where the land was swampy, it was first drained, after which a ditch was dug to the depth of the gum-bearing strata, which seldom exceeded 3 ft. This excavation was expanded and the face advanced until the entire area was covered. As the work progressed the gum encountered was collected, the earth thrown to the rear and the buried wood piled on the surface where it could be burned. Enormous quantities of wood were found and its removal sometimes required the use of explosives, which made the operation expensive. Several hundred acres were dug in this manner, and the ground was left in such condition that its subsequent use for agricultural purposes was possible.

State Stabilizes the Industry

As industrial conditions improved, the face diggings were abandoned and the state instituted its present policy of purchasing kauri at stable market prices. In doing this the state has acted like an ordinary commercial firm, but has carried on the business for the general benefit of the industry rather than for profit. This has provided a market for the gum digger during times of industrial depression and has assured him of a fair price for his product. Government supervision has resulted in the production of a better graded product and a more efficient and less wasteful operation of the industry.

Irregular digging operations are still carried on, and the bulk of the large-sized material is collected in this way. Enormous quantities of small gum are not recovered in these operations, and in the last few years many attempts have been made to devise methods of extraction that would recover this small material. One improved process in successful operation conveys the gum-bearing swampy soil to a sump, where it is agitated with water; this slurry is elevated and passed through a chain disintegrator, which breaks up the soil without crushing the gum. This material is then passed through a series of cylindrical screens of decreasing size, the last being a sixty-four-slotted mesh. The material retained on the screens is dried and passed through a winnowing machine, which classifies the gum into different sizes varying from nuts to dust. Attempts to mine kauri with dredges have not been particularly successful, due to the many difficulties encountered.

Value of Kauri

The total value of the exports of kauri from New Zealand is estimated to be about $100,000,000. From 1905 to 1914 the average yearly export was 8,397 tons, valued at £489,792. The exports fell off during the war period and have not yet recovered completely. The United States, which has always been the greatest consumer, imported during the period from April 1, 1916, to March 31, 1922, 54.7 per cent of the total exports of New Zealand in tonnage and 62.6 per cent in value, as the demand in this country is more active for the high grades of kauri than it is for the cheaper material.

The reserves of kauri remaining in the soil of New Zealand are unknown. It has been stated that as much remains as has been removed. Only the exploration of future years can prove the probability of this statement. The reserves are undoubtedly ample for the demands of industry for many years. Improved methods of recovery may provide large stores of small gum of a quality superior to that of the supplies now available. The fact that the kauri tree is now flourishing also makes it possible to continue the production of gum by scientific bleeding in the same manner that resin is produced in the Southern States from the long leaf pine. Gum produced by the living tree is known as "bush gum," and considerable quantities have been marketed. It was first collected from the ground where it had dropped from the trees. When this supply was exhausted, the trees were attacked and many were badly damaged by unskillful hacking and bleeding. Bush kauri differs in its properties from fossil kauri and has not been so extensively used. Careful orcharding of the kauri tree may establish a profitable industry in the production of both gum and lumber.

Liquid Oxygen Made Available

Liquid oxygen at 75 cents per liter can now be obtained from more than twenty plants throughout the United States. The Purox Co., Denver, Colo., has developed all-metal containers for storing and shipping liquefied gases, which make it possible to ship liquid oxygen several hundred miles by express at regular rates. The loss by evaporation is 4 to 8 per cent in 24 hours, depending on the size of the container.

This development, made possible, of course, by the increasing interest in liquid oxygen explosives, places at the disposal of technologists, research workers and other investigators a convenient method for obtaining extremely low temperatures.

How to Find the Contents of Horizontal Storage Tanks

A Table and Explanation That Simplifies This Annoying Calculation for One Type of Tank and Can Be Easily Applied to Other Types

By Joseph B. Reynolds, Ph.D., and Samuel Cottrell, Ch.E.

ONE very common type of tank consists of a right circular cylinder with its elements horizontal, capped at each end by a portion of a spherical surface. The radius of the end caps is commonly made equal to the diameter of the cylinder, but may have any value greater than the radius of the cylinder. It often becomes necessary to find the volume of liquid in such a tank from a measurement of the depth of the liquid and the known dimensions of the tank. Many formulas and graphical methods of approximating the volume are now used, giving results of varying degrees of accuracy. All prove unsatisfactory in some instances.

It is the purpose of this article to derive an accurate formula for the volume of liquid in the tank for a measured depth in terms of the known dimensions of the tank, and to demonstrate the use of the formula. Tables will be given for facilitating the work of evaluation for the case when the radius of the spherical caps is equal to the diameter of the tank. These tables make it possible in a short time to compute a table of volumes for corresponding depths for any standard tank.

To derive the formula, let l be the length of the cylindrical portion of the tank, a its radius and r the radius of the spherical caps. Let the vertical distance of a horizontal section from the lowest element of the cylinder be x. In the figure $x = ML$ and MOM' is the vertical diameter of one end of the cylinder. The horizontal section intersects this circular end in a chord HLH' which subtends an angle 2θ at the center (O) such that $\theta =$ angle LOH, and it intersects the spherical cap in a segment $HLH'K$ of a circle having the radius $O'K$. Let $\psi =$ the angle $KO'H$. Then

$$x = a(1 - \cos\theta) = 2a \sin^2 \frac{\theta}{2}$$

$$O'L = \sqrt{r^2 - a^2} = a\lambda$$

λ being a proportionality factor introduced for simplification. Also

$$O'K = \sqrt{r^2 - a^2 \cos^2\theta} = a\lambda\sqrt{1 + \frac{\sin^2\theta}{\lambda^2}}$$

And $\tan\psi = \dfrac{\sin\theta}{\lambda}$

The horizontal section consists of a rectangle of length l, width $2a \sin\theta$, and area $2al \sin\theta$, together with two equal segments of a circle with central angle 2ψ and radius $O'K$. The area of each segment is the area of the sector $OHKH'$ less the area of the triangle $OHLH'$ and equals $(O'K)^2\psi - (HL)\sqrt{r^2 - a^2}$, which equals $a^2(\lambda^2 + \sin^2\theta)\psi - a^2\lambda \sin\theta$. Now a differential of the volume of liquid may be taken as the area of this horizontal section times a vertical thickness, dx. If dV is the differential volume, then

$$dV = [2al \sin\theta + 2a^2(\lambda^2 + \sin^2\theta)\psi - 2a^2\lambda \sin\theta]dx$$

Since $x = a(1 - \cos\theta)$, $dx = a \sin\theta\, d\theta$, and replacing ψ by $\tan^{-1} \dfrac{\sin\theta}{\lambda}$

$$V = 2a^2 \int_0^\theta \left[(l - a\lambda) \sin^2\theta + a(\lambda^2 \sin\theta + \sin^2\theta) \tan^{-1}\left(\frac{\sin\theta}{\lambda}\right)\right] d\theta$$

Integrating by parts, one finds

$$V = a^2(l - 2a\lambda - 4/3a\lambda^2)\theta + a^2/6(4a\lambda - 3l)\sin 2\theta + a^3/3 \cos\theta\,[\cos 2\theta - 6\lambda^2 - 5] \tan^{-1}\left(\frac{\sin\theta}{\lambda}\right) + 4/3a^3(\lambda^2 + 1)^{3/2}\tan^{-1}\left(\frac{\sqrt{1+\lambda^2}}{\lambda}\right) \tan\theta$$

in which $\theta = 2 \sin^{-1}\sqrt{\dfrac{x}{2a}}$ and ranges from 0 to 180 deg. $\mathrm{Tan}^{-1}\left(\dfrac{\sqrt{1+\lambda^2}}{\lambda} \tan\theta\right)$ ranges from 0 to π. When $\theta = 0$ or π, $\tan^{-1}\left(\dfrac{\sin\theta}{\lambda}\right) = 0$.

It will be noticed that by setting

$$X = \theta - 1/2 \sin 2\theta$$

and

$$Y = -2\lambda\theta - 4/3\lambda^2\theta + 2/3\lambda \sin 2\theta + 1/3 \cos\theta[\cos 2\theta - 6\lambda^2 - 5]\tan^{-1}\left(\frac{\sin\theta}{\lambda}\right) + 4/3(\lambda^2 + 1)^{3/2}\tan^{-1}\left(\frac{\sqrt{1+\lambda^2}}{\lambda} \tan\theta\right)$$

the formula may be written

$$V = Xa^2l + Ya^3$$

When X and Y are known, it is an easy matter

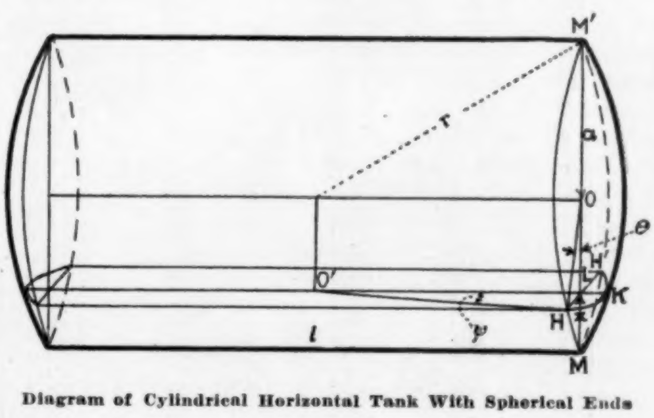


Diagram of Cylindrical Horizontal Tank With Spherical Ends

either by multiplication or the use of logarithms to compute the value of V, since l and a are known dimensions of the tank and do not vary for different values of X and Y.

If it be required to compute a table giving the volume for each inch of depth for a standard tank, after figuring the corresponding percentages of the diameter for each inch of depth, the tabular values of X and Y make it possible in a short time to complete the computation.

If desired, instead of measuring the depth in inches, a measuring scale might be constructed that would

Table of Factors for Tank Calibration

In this table the values of X, log X, Y and log Y are given for each value of $p = x/2a$ corresponding to each five-thousandth part, or each half of 1 per cent of the diameter of the standard tank in which the radius of the spherical ends equals the diameter of the tank.

p % Diam.	X	Log X	Y	Log Y	p % Diam.	X	Log X	Y	Log Y
0.5	0.0022	7.34242—10	.....	....	50.5	1.5908	0.20162	0.441	9.64444—10
1.0	.0054	7.73239—10	0.001	7.00000—10	51.0	1.6108	.20704	.448	9.65128—10
1.5	.0098	7.99123—10	.001	7.00000—10	51.5	1.6308	.21240	.456	9.65896—10
2.0	.0150	8.17609—10	.001	7.00000—10	52.0	1.6507	.21767	.463	9.66558—10
2.5	.0210	8.32222—10	.001	7.00000—10	52.5	1.6707	.22290	.470	9.67210—10
3.0	.0275	8.43933—10	.001	7.00000—10	53.0	1.6907	.22807	.477	9.67852—10
3.5	.0336	8.52634—10	.002	7.30103—10	53.5	1.7107	.23317	.484	9.68485—10
4.0	.0422	8.62531—10	.002	7.30103—10	54.0	1.7306	.23820	.491	9.69108—10
4.5	.0502	8.70070—10	.003	7.47712—10	54.5	1.7505	.24316	.498	9.69723—10
5.0	.0587	8.76864—10	.003	7.47712—10	55.0	1.7704	.24807	.505	9.70329—10
5.5	.0677	8.83059—10	.004	7.60206—10	55.5	1.7903	.25293	.513	9.71012—10
6.0	.0770	8.88649—10	.004	7.60206—10	56.0	1.8102	.25773	.520	9.71600—10
6.5	.0867	8.93802—10	.005	7.69897—10	56.5	1.8300	.26245	.527	9.72181—10
7.0	.0967	8.98543—10	.005	7.69897—10	57.0	1.8498	.26712	.534	9.72754—10
7.5	.1071	9.02979—10	.006	7.77815—10	57.5	1.8696	.27175	.541	9.73320—10
8.0	.1178	9.07115—10	.007	7.84510—10	58.0	1.8894	.27632	.548	9.73878—10
8.5	.1288	9.10992—10	.009	7.95424—10	58.5	1.9091	.28083	.555	9.74429—10
9.0	.1401	9.14644—10	.010	8.00000—10	59.0	1.9288	.28529	.562	9.74974—10
9.5	.1517	9.18099—10	.012	8.07918—10	59.5	1.9485	.28970	.569	9.75511—10
10.0	.1635	9.21352—10	.013	8.11394—10	60.0	1.9681	.29405	.576	9.76042—10
10.5	.1757	9.24477—10	.015	8.17609—10	60.5	1.9876	.29833	.583	9.76567—10
11.0	.1880	9.27416—10	.017	8.23045—10	61.0	2.0071	.30257	.590	9.77085—10
11.5	.2007	9.30255—10	.019	8.27875—10	61.5	2.0266	.30677	.597	9.77597—10
12.0	.2135	9.32940—10	.021	8.32222—10	62.0	2.0461	.31093	.603	9.78032—10
12.5	.2266	9.35526—10	.024	8.38021—10	62.5	2.0655	.31503	.610	9.78533—10
13.0	.2399	9.38003—10	.026	8.41497—10	63.0	2.0848	.31906	.616	9.78958—10
13.5	.2535	9.40398—10	.029	8.46240—10	63.5	2.1041	.32307	.623	9.79449—10
14.0	.2673	9.42700—10	.031	8.49136—10	64.0	2.1234	.32703	.629	9.79865—10
14.5	.2813	9.44917—10	.034	8.53148—10	64.5	2.1426	.33094	.636	9.80346—10
15.0	.2955	9.47056—10	.036	8.55630—10	65.0	2.1617	.33480	.642	9.80754—10
15.5	.3100	9.49136—10	.039	8.59106—10	65.5	2.1807	.33860	.648	9.81158—10
16.0	.3245	9.51121—10	.042	8.62325—10	66.0	2.1997	.34236	.654	9.81558—10
16.5	.3392	9.53046—10	.045	8.65321—10	66.5	2.2186	.34608	.661	9.82020—10
17.0	.3541	9.54913—10	.048	8.68124—10	67.0	2.2374	.34974	.667	9.82413—10
17.5	.3692	9.56726—10	.052	8.71600—10	67.5	2.2562	.35338	.673	9.82802—10
18.0	.3845	9.58490—10	.055	8.74036—10	68.0	2.2749	.35696	.679	9.83187—10
18.5	.4000	9.60206—10	.059	8.77085—10	68.5	2.2935	.36050	.685	9.83569—10
19.0	.4156	9.61868—10	.062	8.79239—10	69.0	2.3121	.36401	.690	9.83885—10
19.5	.4315	9.63498—10	.066	8.81954—10	69.5	2.3305	.36745	.696	9.84261—10
20.0	.4473	9.65060—10	.069	8.83885—10	70.0	2.3489	.37086	.702	9.84634—10
20.5	.4634	9.66596—10	.073	8.86332—10	70.5	2.3672	.37424	.708	9.85003—10
21.0	.4796	9.68088—10	.077	8.88649—10	71.0	2.3854	.37756	.713	9.85309—10
21.5	.4961	9.69557—10	.081	8.90849—10	71.5	2.4035	.38084	.719	9.85673—10
22.0	.5125	9.70969—10	.085	8.92942—10	72.0	2.4215	.38408	.724	9.85974—10
22.5	.5291	9.72354—10	.089	8.94939—10	72.5	2.4394	.38728	.730	9.86332—10
23.0	.5459	9.73711—10	.093	8.96848—10	73.0	2.4572	.39044	.735	9.86629—10
23.5	.5628	9.75035—10	.098	8.99123—10	73.5	2.4749	.39356	.740	9.86923—10
24.0	.5798	9.76328—10	.102	9.00860—10	74.0	2.4925	.39664	.745	9.87216—10
24.5	.5969	9.77590—10	.107	9.02938—10	74.5	2.5100	.39967	.750	9.87506—10
25.0	.6142	9.78831—10	.111	9.04532—10	75.0	2.5274	.40267	.755	9.87795—10
25.5	.6317	9.80051—10	.116	9.06446—10	75.5	2.5446	.40562	.760	9.88081—10
26.0	.6491	9.81231—10	.121	9.08279—10	76.0	2.5618	.40855	.764	9.88309—10
26.5	.6667	9.82393—10	.126	9.10037—10	76.5	2.5788	.41142	.769	9.88593—10
27.0	.6844	9.83531—10	.131	9.11727—10	77.0	2.5957	.41425	.773	9.88818—10
27.5	.7023	9.84652—10	.137	9.13672—10	77.5	2.6124	.41704	.777	9.89042—10
28.0	.7201	9.85739—10	.142	9.15229—10	78.0	2.6291	.41981	.781	9.89265—10
28.5	.7381	9.86812—10	.148	9.17026—10	78.5	2.6456	.42252	.785	9.89487—10
29.0	.7562	9.87864—10	.153	9.18469—10	79.0	2.6620	.42521	.789	9.89708—10
29.5	.7744	9.88897—10	.159	9.20140—10	79.5	2.6782	.42784	.793	9.89927—10
30.0	.7927	9.89911—10	.164	9.21484—10	80.0	2.6943	.43045	.797	9.90146—10
30.5	.8100	9.90849—10	.170	9.23045—10	80.5	2.7102	.43300	.801	9.90363—10
31.0	.8295	9.91882—10	.176	9.24551—10	81.0	2.7260	.43553	.804	9.90526—10
31.5	.8481	9.92845—10	.182	9.26007—10	81.5	2.7416	.43800	.808	9.90741—10
32.0	.8667	9.93787—10	.187	9.27184—10	82.0	2.7571	.44045	.811	9.90902—10
32.5	.8854	9.94714—10	.193	9.28556—10	82.5	2.7723	.44284	.815	9.91116—10
33.0	.9042	9.95626—10	.199	9.29885—10	83.0	2.7875	.44521	.818	9.91275—10
33.5	.9239	9.96563—10	.206	9.31387—10	83.5	2.8024	.44753	.821	9.91434—10
34.0	.9419	9.97400—10	.212	9.32634—10	84.0	2.8171	.44980	.824	9.91593—10
34.5	.9609	9.98268—10	.218	9.33846—10	84.5	2.8317	.45205	.827	9.91751—10
35.0	.9799	9.99118—10	.224	9.35025—10	85.0	2.8461	.45425	.830	9.91908—10
35.5	.9991	9.99961—10	.231	9.36361—10	85.5	2.8603	.45641	.833	9.92065—10
36.0	1.0182	.00783	.237	9.37475—10	86.0	2.8743	.45853	.835	9.92169—10
36.5	1.0375	.01599	.244	9.38739—10	86.5	2.8881	.46061	.838	9.92324—10
37.0	1.0568	.02399	.250	9.39794—10	87.0	2.9017	.46265	.840	9.92428—10
37.5	1.0762	.03189	.257	9.40993—10	87.5	2.9150	.46464	.843	9.92583—10
38.0	1.0955	.03961	.263	9.41996—10	88.0	2.9281	.46659	.845	9.92686—10
38.5	1.1150	.04727	.270	9.43136—10	88.5	2.9410	.46850	.847	9.92788—10
39.0	1.1345	.05480	.276	9.44091—10	89.0	2.9536	.47035	.849	9.92891—10
39.5	1.1540	.06221	.283	9.45179—10	89.5	2.9660	.47217	.851	9.92993—10
40.0	1.1735	.06948	.290	9.46240—10	90.0	2.9781	.47394	.853	9.93095—10
40.5	1.1932	.07671	.297	9.47276—10	90.5	2.9899	.47566	.855	9.93197—10
41.0	1.2128	.08379	.304	9.48287—10	91.0	3.0015	.47734	.856	9.93247—10
41.5	1.2325	.09079	.311	9.49276—10	91.5	3.0127	.47896	.858	9.93349—10
42.0	1.2522	.09767	.318	9.50243—10	92.0	3.0238	.48055	.859	9.93399—10
42.5	1.2720	.10449	.325	9.51188—10	92.5	3.0345	.48209	.860	9.93450—10
43.0	1.2918	.11120	.332	9.52114—10	93.0	3.0449	.48357	.861	9.93500—10
43.5	1.3116	.11780	.339	9.53020—10	93.5	3.0549	.48500	.862	9.93551—10
44.0	1.3314	.12431	.346	9.53908—10	94.0	3.0646	.48637	.862	9.93551—10
44.5	1.3513	.13075	.354	9.54900—10	94.5	3.0739	.48769	.863	9.93601—10
45.0	1.3712	.13710	.361	9.55751—10	95.0	3.0829	.48896	.863	9.93601—10
45.5	1.3911	.14336	.368	9.56585—10	95.5	3.0914	.49016	.864	9.93651—10
46.0	1.4110	.14953	.375	9.57403—10	96.0	3.0994	.49128	.864	9.93651—10
46.5	1.4310	.15564	.382	9.58206—10	96.5	3.1070	.49234	.865	9.93702—10
47.0	1.4509	.16164	.389	9.58995—10	97.0	3.1141	.49333	.865	9.93702—10
47.5	1.4709	.16758	.396	9.59770—10	97.5	3.1208	.49427	.865	9.93702—10
48.0	1.4909	.17345	.403	9.60531—10	98.0	3.1266	.49507	.865	9.93702—10
48.5	1.5109	.17924	.411	9.61384—10	98.5	3.1319	.49581	.865	9.93702—10
49.0	1.5308	.18492	.418	9.62118—10	99.0	3.1362	.49640	.865	9.93702—10
49.5	1.5508	.19056	.426	9.62941—10	99.5	3.1394	.49685	.866	9.93752—10
50.0	1.5708	.19612	.433	9.63649—10	100.0	3.1416	.49715	.866	9.93752—10

measure the depth directly in thousandths of the diameter.

The values in the table have been carefully computed and places enough are given to insure an accuracy in the volume well within the limits of measurement and variations in the tank due to rivet heads, seams, etc.

If the tank is so designed that the heads are convex inward instead of outward, the formula becomes

$$V = Xa^2l - Ya^3$$

and the tables may be used with equal facility. If the tank is made with one head dished outward and the other head dished inward the formula becomes simply

$$V = Xa^2l$$

Use of Tables

As an example suppose a standard tank 24 ft. in cylindrical length and 8 ft. in diameter contains a depth of 2 ft. of liquid; to find the volume.

Here $l = 24$, $a = 4$ and therefore
$V = 384X + 64Y$ for this tank.

For a depth of liquid of 2 ft., $p = x/2a = 2/8 = 25.0$ per cent. From the table for $p = 25.0$ per cent, $X = 0.6142$, $Y = 0.111$, whence

$$V = 384(0.6142) + 64(0.111)$$
$$= 235.85 + 7.10 = 242.95 \text{ cu.ft.}$$

Or, using logarithms

$$\log 384X = \log 384 + \log X =$$
$$2.58433 + 9.78831 - 10 = 2.37264$$
$$\log\ 64Y = \log\ 64 + \log Y =$$
$$1.80618 + 9.04532 - 10 = 0.85150$$

taking the logarithms of the numbers from a table of logarithms and the logarithms of X and Y from table for $p = 25.0$ per cent. From the resulting logarithms one finds.

$384X = 235.85$ and $64Y = 7.10$ and therefore
$V = 242.95$ cu.ft. as before.

Tables like those of this article can be computed for odd-proportioned tanks by first evaluating λ by $\lambda = \frac{\sqrt{r^2 - a^2}}{a}$ for the particular tank and then computing X and Y for successive values of θ determined by equal increments in x in $\theta = 2 \sin^{-1}\sqrt{x/2a}$.

Belgian Glass Industry Active

The glass-manufacturing industry of Belgium is in an exceedingly flourishing condition, most factories running at full head, as indeed they have for some months past. The present monthly production of the principal plants is given as follows: Glaces Nationales, 72,000 sq.m.; Charleroi and Auvelais, 500,000 sq.m.; Moustier, 52,800 sq.m.; Floreffe and Saint Marie, 360,000 sq.m.

The workers have accepted a proposition of the employers to work on Sunday and a diminution of 20 per cent on the actual wages paid with a view to assuring Belgium of a price pre-eminence for window glass in world markets. It is thought the incident may be considered as remarkable, but it is recognized as being preferable to losing trade abroad and possibly shutting down or running the plants on part time. The Franco-German trade accord is recognized to be possible as a result of Germany's proposition that France should go out from the Ruhr at a date previous to that provided by the London agreement.

Factors for Computing the Volumes of Cylindrical and Rectangular Vessels

By E. F. Hickson
U. S. Bureau of Standards, Washington, D. C.

Capacity and Volume Formulas for Vertical Cylindrical Vessels

d = diameter
h = vertical height or depth } when measured in inches
(Pipes, cylinders, etc.)

$d^2h \times 12.87$	= c.c.
$d^2h \times 3.482$	= fluid dram.
$d^2h \times 0.7854$	= cu.in.
$d^2h \times 0.4352$	= U. S. liquid oz.
$d^2h \times 0.0272$	= U. S. liquid pt.
$d^2h \times 0.0136$	= U. S. liquid qt.
$d^2h \times 0.0129$	= liters
$d^2h \times 0.00340$	= U. S. gal.
$d^2h \times 0.000455$	= cu.ft.
$d^2h \times 0.000365$	= U. S. bu.
$d^2h \times 0.000129$	= hl.
$d^2h \times 0.0000168$	= cu.yd.
$d^2h \times 0.0000128$	= cu.m.

Capacity and Volume Formulas for Vertical Cylindrical Vessels

D = diameter
H = height or depth } when measured in feet
(Tanks, cisterns, etc.)

$D^2H \times 22240$	= c.c.
$D^2H \times 6016$	= fluid dram.
$D^2H \times 1357.2$	= cu.in.
$D^2H \times 752.0$	= U. S. liquid oz.
$D^2H \times 47.00$	= U. S. liquid pt.
$D^2H \times 23.50$	= U. S. liquid qt.
$D^2H \times 22.240$	= liters
$D^2H \times 5.8752$	= U. S. gal.
$D^2H \times 0.7854$	= cu.ft.
$D^2H \times 0.6311$	= U. S. bu.
$D^2H \times 0.2224$	= hl.
$D^2H \times 0.02909,$	= cu.yd.
$D^2H \times 0.02224$	= cu.m.

Capacity and Volume Formulas for Rectangular Vessels

a =
b = } 3 dimensions when measured in inches
c =

$abc \times 16.387$	= c.c.*
$abc \times 4.433$	= fluid dram.
abc	= cu.in.
$abc \times 0.5541$	= U. S. liquid oz.
$abc \times 0.0346$	= U. S. liquid pt.
$abc \times 0.0173$	= U. S. liquid qt.
$abc \times 0.0164$	= liters
$abc \times 0.00433$	= U. S. gal.
$abc \times 0.000579$	= cu.ft.
$abc \times 0.000465$	= U. S. bu.
$abc \times 0.0000214$	= cu.yd.
$abc \times 0.0000170$	= cu.m.

*1 cu in. = 16.3872 c.c.
= 16.3867 ml.

Capacity and Volume Formulas for Rectangular Vessels

A =
B = } 3 dimensions when measured in feet
C =

$ABC \times 28317$	= c.c.
$ABC \times 7660$	= fluid dram.
$ABC \times 1728.0$	= cu.in.
$ABC \times 957.5$	= U. S. liquid oz.
$ABC \times 59.84$	= U. S. liquid pt.
$ABC \times 29.92$	= U. S. liquid qt.
$ABC \times 28.317$	= liters
$ABC \times 7.4805$	= U. S. gal.
ABC	= cu.ft.
$ABC \times 0.8036$	= U. S. bu.
$ABC \times 0.03704$	= cu.yd.
$ABC \times 0.02832$	= cu.m.

For more exact relations see Bureau of Standards Circular 47, "Units of Weight and Measure."

Equipment News

From Maker and User

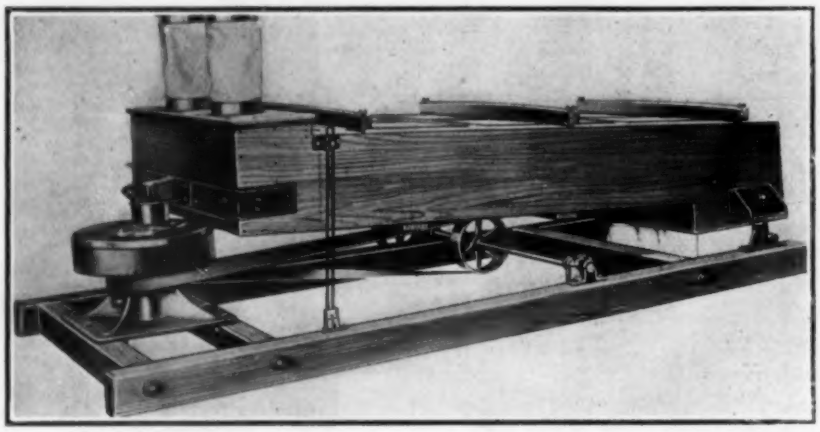


Fig. 1—Gyratory Screening Machine

The material enters at the highest end through the flexible spouts and is distributed evenly over the full width of the sieve. The gyratory motion and the nearly level position of the sieves produces a stratifying effect on the stock that causes the fine material to settle next to the cloth while the coarse materials float on the top and pass out over the tail end of the sieve. This action is claimed to insure the greatest efficiency possible in screening.

Screening Machine

A new screening machine or sifter that should prove of interest to many manufacturers is the "Gyro-Sifter," made by the Robinson Manufacturing Co., Muncy, Pa. This machine, shown assembled in Fig. 1, can be built either with one screening surface or several, one above the other. The frame is either of wood or metal, as may be indicated by the use to which it is to be put. The screen clothing is of either wire or silk cloth, of any mesh, depending on the product to be screened and the capacity desired.

The cloth cleaning system consists of resilient rubber balls, a number of which are confined in each of the small compartments formed between the upper and lower screen clothing by means of hardwood crosspieces.

The gyratory motion of the sieve box causes the balls to travel over the ridged surface of the under cloth, which deflects them upward against the upper or screening cloth. In this way the whole surface is constantly jarred and thus the meshes are kept cleaned out as long as the machine is in motion. The size and number of these balls is varied according to the material to be screened.

A partial list of materials already successfully screened with this machine follows:

Abrasives
Antimony
Asbestos
Asphaltum
Baking Powder
Barytes
Bauxite
Beet Pulp
Bicarbonate of Soda
Blue Lead
Bone Black
Borax
Calcined Magnesia
Calcium Acid Phosphate
Calcium Carbide
Carbon Black
Carborundum
Casein
Cement
Chalk
Charcoal
China Clay
Citric Acid
Clay
Coal, Ground
Copra Meal
Cottonseed Meal
Cream Tartar
Dyes
Earths
Enamel, Liquid
Explosive Ingredients
Fertilizer
Flue Dust
Fullers Earth
Gelatin
Glue
Graphite
Gum Arabic
Hydrated Lime
Insect Powder
Iron Oxide
Lamp Black
Lime
Litharge
Lithopone
Magnesite
Maltose Dextrine
Meat Scrap
Milk Powder
Milk Sugar
Nitrates
Paris Green
Phosphate Rock
Porcelain, Ground
Pulp
Rosin
Rubber
Salt
Silica
Soap Powder
Soda Ash
Sodium Phosphate
Starch
Sugar
Sulphur
Tankage
Tannic Acid
Tartaric Acid
Whiting
White Lead, Solution
Wood Chips
Zinc Oxide

Fig. 3—Method of Supporting Screen

The driving mechanism supports the sieve box at the head end while an inverted "V"-shaped saddle on each side of the box supports the tail end. These saddles are mounted on a semi-rotating pedestal pin and afford ample bearing surface to carry the weight of the machine without undue friction. Their design assures central alignment at all times regardless of wear, and they are so constructed that at no time is any part of the bearing surface exposed for the accumulation of dust. A grease cup is provided for lubrication and no attention is required other than occasional renewal of grease.

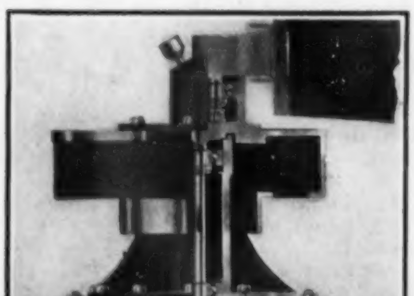


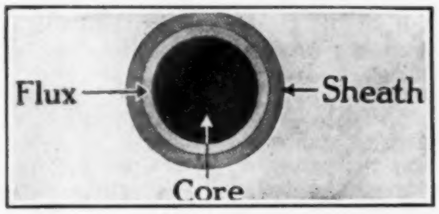
Fig. 2—Driving Mechanism of Screen

This consists of a large counter-balanced wheel mounted on a short trunnion, which is supported on ball bearings and carried within a rigid pedestal. This entire driving unit is held in position by bridgetrees securely fastened to the frame. The counter-balanced wheel is connected to the sieve box by means of a driving head, which is fastened to a channel bar, forming practically the entire head end of the sieve box. The connection between the balance wheel and the driving head is made through a self-aligning ball bearing inclosed in a dust- and oil-proof casing. The entire driving mechanism is mounted on ball bearings, is self-contained, runs noiselessly, and requires the minimum amount of power, lubricant and attention. The machine is driven by means of a quarter twist belt from a countershaft located on the frame. The throw of the box is accurately counter-balanced by means of weights in the large counter-balanced wheel, which can be increased or diminished as the situation requires. This is done by simply lifting out the removable section of the top plate and adding or removing some of the weights, a sufficient number of which are furnished with the machine.

Welding Galvanized and Cast Iron

The welding of cast iron has long been accomplished with difficulty and the welding of galvanized iron, without damage to the metal, has been considered an impossibility. It is, therefore, with great interest that the new General Electric Co. Type A Welding Electrode is noted.

This electrode, shown in the accompanying sketch, consists of a central metallic core surrounded by a layer of flux, which is protected by a metallic sheath. It is recommended for all cast-iron welding and for both hand and automatic machine welding of galvanized iron. In welding galvanized iron, it is recommended for butt or edge welds on thin metal sheets or plates, in making the seams of vessels, pipes, etc. Such welds are made with a single



Magnified Cross-Section of New Welding Electrode

bead along the seams. Welds in cast iron are made in the usual manner.

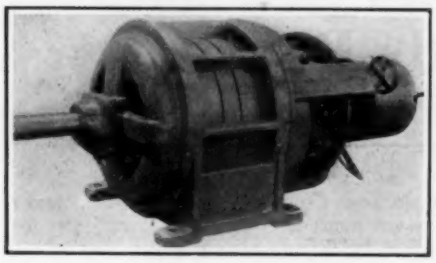
The General Electric Co. claims as advantages for this electrode arc stability, ease of manipulation, rapid deposition, good penetration, sound tough welds and maximum economy. The new electrode is supplied in diameters of $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{1}{4}$ in. The $\frac{1}{4}$-in. size is furnished in 22-in. lengths and in 200-lb. quantities on reels. All other sizes can be supplied either in 14-in. lengths or on 200-lb. reels. Short lengths are wrapped in burlap in bundles of 50 lb.

Adjustable Speed Motor

A new type of motor has been developed, the only self-contained, adjustable speed, alternating current motor with shunt characteristics on the market. It has been designed to cover the wide field of applications requiring such characteristics, an inherent feature being that its change of speed is moderate only as compared to the change of load.

The new motor, known as type BTA, is made by the General Electric Co., and is available for use on three-phase, sixty-cycle circuits at 220, 440 or 550 volts. It is commonly built for a three-to-one speed range and is rated on a constant torque basis, with horsepower output directly proportional to speed. Motors for other speed ranges and frequencies as well as for two-phase service will also be made.

The motors now being marketed range from 3/1 hp., 1650/550 r.p.m., to 50/16.7 hp., 1250/415 r.p.m., the lower horsepower sizes being six-pole and the larger eight-pole machines. The motors are designed to be thrown



New Adjustable Speed, Brush Shifting A.C. Motor

on the line with brushes in low speed position and may be connected in the same manner as any three-phase induction motor. Speed is varied by brush-shifting, accomplished by the use of a handwheel or by a pilot motor shifting the brushes through a gear train and operated by push-button control or by an automatic regulator. The brushes may also be shifted manually from a distance by using a handwheel bracket with chain and sprocket.

With brushes at low speed position, this type of motor is designed to give from 150 to 200 per cent of normal torque at starting with 125 to 160 per cent full speed line current. The maximum torque at low speeds is from 150 to 200 per cent of normal torque and increases for the high speed position to from 300 to 400 per cent of normal torque.

The efficiency of this motor remains nearly constant over the greater part of the speed range, but is somewhat lower at very slow speeds. Power factor is very high when the motor is running at high speeds. At synchronous speed, the power factor is about the same as that of an induction motor of similar rating. By using a secondary resistance and contactor, a creeping speed of half the listed minimum speed may be obtained.

Among the applications for which the BTA motor is recommended by the manufacturer are aluminum foil machines, bakery machinery, boiler house fans, centrifugal compressors and pumps, cloth printing machines, cotton and wool spinning frames, newspaper presses, oil refinery Cross process pumps, some machine tools, stokers, tentering frames in textile plants and tube machines and calenders in rubber goods factories.

Steam Trap for High Pressure and Temperature

A new steam trap designed for extreme pressure and temperature service has just been placed on the market by the Armstrong Machine Works, Three Rivers, Mich. The body and cap of this trap are made of annealed cast steel of 70,000 lb. tensile strength and the traps are tested under 3,000 lb. per square inch hydraulic pressure to insure tightness of valves, joints and castings. The valves are furnished with orifices suitable to pressures up to 600 lb. or higher in special cases. Operation is by the patented principle familiar in standard Armstrong traps. There are three sizes of this new trap made in capacities of 62, 312 and 757 gal. per hour at 300 lb. pressure.

Manufacturers' Latest Publications

Crescent Refractories Co., Curwensville, Pa.—New data sheets as follows: Series 1, No. 5, tables of brick required for the fronts of boiler settings; Series 1, No. 6, on determining the combination of arch, wedge or key brick to turn a given circle.

The Dorr Co., 247 Park Ave., New York.—A bulletin entitled "Turning Slush Into Profit," and describing the recovery of fine coal and waste water, the prevention of stream pollution and the neutralization and clarification of acid mine waters in both the anthracite and the bituminous field.

Shore Instrument & Mfg. Co., 9025 Van Wyck Ave., Jamaica, N. Y.—Bulletin 35, covering the "Sico" automatic actuator for operating scleroscopes. Bulletin 40, on the tilting base and clamping swing arm scleroscope set.

Copper & Brass Research Association, 25 Broadway, New York.—Bulletin 27. The latest issue of bulletin on the uses of copper and brass.

W. S. Rockwell Co., 50 Church St., New York.—Bulletin 261. A bulletin on Rockwell Automatic Rotary Furnaces and quenching, coating or coloring tanks for continuous heating, quenching and processing.

Vilter Mfg. Co., Milwaukee, Wis.—Bulletin 19. This bulletin gives the floor space requirements of Vilter ammonia compressors. Bulletin 29R. A bulletin describing the Vilter twin cylinder, vertical, inclosed type ammonia compressor.

Dings Magnetic Separator Co., Milwaukee, Wis.—A folder on the use of Dings separators for guarding crushers against tramp iron.

Steere Engineering Co., Detroit.—Pamphlet 265. A leaflet on steel pipe for city gas service.

The Bristol Co., Waterbury, Conn.—Bulletin 330. A leaflet describing high resistance model 420 indicating pyrometer.

Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, E. C. 1, England.—Bulletin 33. A bulletin on heat-treating, covering the subject of methods of heating for steel hardening.

Eimer & Amend, 18th St. and Third Ave., New York.—A new handbook on chemicals and reagents in metric units, giving list of most important chemical reagents, especially the chemically pure and the tested purity grades.

Combustion Engineering Corporation, New York City.—A new bulletin on the Hermansen patent recuperator furnace for use in the non-ferrous metal field.

Frank P. Fahy, 50 Church St., New York City—A catalog describing the Fahy laminated yoke type Simplex Permeameter, an instrument for evaluating the physical properties of metals by magnetic testing.

Century Wood Preserving Co., Century Bldg., Pittsburgh, Pa.—A new bulletin on wood preserving, treating of "How Great a Cost Is Justified for the Treatment of Lumber and Timbers."

Steere Engineering Co., Detroit, Mich.—Pamphlet 268. A leaflet dealing with extensions in the adoption of the backrun process of water-gas manufacture.

Wittemann Bros., Ferris & Sullivan Sts., Brooklyn, N. Y.—A new bulletin describing various types of "Faust" mixing and grinding equipment made by this company.

General Electric Co., Schenectady, N. Y.—A catalog describing the new "Type A" electric welding electrode.

Armstrong Machine Works, Three Rivers, Mich.—Bulletin A. A catalog of steam traps for service with high pressures and superheats.

The Dorr Co., 247 Park Ave., New York.—Bulletin 13. A catalog called "Dorrco Diaphragm Pumps," dealing with the suction type, an open discharge diaphragm pump for use where the total lift is not more than 14 ft., and the pressure type, a pump that will pump against a considerable pressure head.

Vulcan Iron Works, Wilkes-Barre, Pa.—A catalog describing the Meade Improved Vertical Lime Kiln as manufactured by this company.

Books Recently Received

International Statistics on Vegetable Oils

OLEAGINOUS PRODUCTS AND VEGETABLE OILS: PRODUCTION AND TRADE. 500 pages. Compiled by the Bureau of Statistics, International Institute of Agriculture, and published by the Institute, Rome, Italy. Copies may be obtained from the Interstate Cottonseed Crushers Association, 606 Continental Trust Bldg., Washington, D. C. Price, $3.

World-wide interest in vegetable oil resources particularly manifest after the war prompted the International Institute of Agriculture to make a survey of the situation throughout the world. Much difficulty was encountered in obtaining statistics and trade information for some countries, but in September, 1921, a monograph was published in French covering the data then available. The work was continued and is now available in this English edition, which has been brought down through the year 1922 wherever possible.

A general survey of the principal crops (cotton, linseed, rapeseed and mustardseed, peanuts or ground nuts, soya beans, sesamum, olive, coconuts and oil palms) is followed by 400 pages of statistical information by countries, data being given for 170 countries. It was found imperative to limit the number of crops to be considered and on the basis of prominence in international markets the following were selected: cotton, linseed, hempseed, rapeseed, mustardseed, sunflower, poppyseed, castorseed, ground nut (peanut), soya, sesamum, olive, coconut and oil palm. Where other crops of special interest in particular countries are of importance, such information has also been included. Part II gives recapitulatory tables on area and production of the different crops from 1909 to 1922.

The work presents an authoritative survey of world conditions in an important industry and merits careful study by all interested in these commodities.

Silica Refractories

THE SILICA REFRACTORIES OF PENNSYLVANIA. By *E. S. Moore*, dean, School of Mines, State College, Pa., and *T. G. Taylor*. 93 pages, illustrated. Bulletin M3. Fourth Series, Pennsylvania Geological Survey, Harrisburg, Pa.

Pennsylvania's prominence as a producer of silica brick, averaging more than 70 per cent of the country's output, makes this report of unusual value to all interested in the silica brick industry. The extensive deposits of quartzite are discussed in detail, the manufacturing operations are outlined and the plants of the following companies are briefly described: Harbison-Walker Refractories Co., Superior Silica Brick Co., Federal Refractories Co., General Refractories Co., United States Refractories Corporation, Standard Refractories Co., Haws Refractories Co., Van Dyke Silica Brick Co., E. J. Lavino Refractories Co., E. R. Baldridge Co., J. L. Hartman Co. Data on chemical and physical properties of silica brick are also given.

Chemical Engineering Catalog

CHEMICAL ENGINEERING CATALOG. Ninth annual edition, 1924. 1079 pages, illustrated. Chemical Catalog Co., New York. Leased at $2 per copy for the period of one year to chemical engineers and members of certain other technical classifications.

Following the general arangement of recent editions, this volume is divided into four sections. The first, 266 pages in length, is the classified index of equipment and materials. Condensed catalogs of chemical engineering equipment, arranged alphabetically by manufacturer, form the second section, 616 pages. In the third section, 103 pages, similar data are given by producers of chemicals and materials, while the last part, 106 pages, is an index to the contents of more than 1,300 technical books.

Lac Industry

LAC AND ITS INDUSTRIAL TREATMENT. A report by *M. Hautefeuille* on the lac industry in Indo-China, translated into English by Syed Mahdihassan, Indian Institute of Science, formerly chemist, Industrial Laboratory, Hyderabad. 89 pages. Published as Bulletin 2, Industrial Laboratory, Department of Industries and Commerce, H. E. H. the Nizam's Government, Hyderabad-Deccan, India.

Speaking of M. Hautefeuille's work, Dr. M. O. Forster, director, Indian Institute of Science, in the foreword to this book says: "The main purpose of M. Hautefeuille's mission was to investigate *in situ* the lac-producing resources of Indo-China with a view to improvement of quality, increase of output and correction of errors in manufacture. To the increasing number of scientific workers who have concerned themselves with the various problems cognate to this old and surprising industry, the experiences and conclusions of the French investigator cannot fail to be of the highest interest and it is from this standpoint that Mr. Mahdihassan, the Indian entomologist, has rendered great service by giving to M. Hautefeuille's memoir the prominence it deserves."

STATISTICS OF LAC PRODUCTION. By *S. Mahdihassan*, Indian Institute of Science, Bangalore. Journal of the Science Association, Maharajah's College, Viziahagaram, S. India, vol. I, No. 4, 1924, pp. 125-132.

FUNDAMENTALS OF INTENSIVE LAC PRODUCTION. By *M. Srinivasayya*, Indian Institute of Science, Bangalore. Journal of the Science Association, Maharajah's College, Vizianagaram, S. India, Vol. I, No. 4, 1924, pp. 133-145.

These two articles are so closely related to the subject covered by the above report that they are worthy of mention in connection with it. Both discuss the Indian lac industry, emphasizing some of the work that is being done to assure increasing supplies of shellac and thus forestall as far as possible attempts to produce synthetic substitutes.

Foreign Mineral Statistics

STATISTIQUE DE L'INDUSTRIE MINÉRALE ET DES APPAREILS À VAPEUR EN FRANCE ET EN ALGÉRIE, 1921. 332 pages. Imprimerie Nationale, Paris. Price, 40 francs.

ANUARIO DE ESTADISTICA MINERA, 1922. 240 pages. Departamento de Minas, Secretaria de Industria, Comercio y Trabajo, Mexico City, Mexico.

Other New Publications

The British Engineers Association Directory of Members and Their Manufactures, 1924, published by the British Engineers Association, 32 Victoria St., London, S. W. 1, England. The object of the directory is to provide information of real use to all interested in British engineering products. It contains the names, addresses, telegraphic addresses, codes and full details concerning British manufacturing engineers, and includes practically every known manufacture. This is the sixth edition. The British Engineers Association's objects and activities are set out in the fore part of the book. Upon request the association will send a copy of this directory to any user of engineering plant and machinery in the United States.

Bureau of Mines

Size and Character of Grains of Non-Metallic Mineral Fillers, by *W. M. Weigel*. Tech. Paper 296.

Bureau of Standards

Recommended Specification for Quicklime and Hydrated Lime for Use in the Absorption of Carbon Dioxide. Circular 180.

Influence of Sulphur, Oxygen, Copper and Manganese on the Red-Shortness of Iron, by *J. R. Cam*. Tech. Paper 261.

Book Review

Colloids in Theory and Practice

THE THEORY AND APPLICATION OF COLLOIDAL BEHAVIOR. *Robert Herman Bogue*, editor. 1st edition. 2 volumes, 829 pages. McGraw-Hill Book Co., Inc., New York City, 1924. Price $8.

These two volumes contain thirty-five chapters on a wide variety of colloid subjects contributed by thirty-four recognized authorities. The multifariousness of the applications of colloid science is attested by the wide field, both geographically and occupationally, from which the writers have been selected. Less than half are drawn from the universities; eight are connected with industrial organizations, six with state and government laboratories, and four

with research institutes. There are three from England and two each from Canada and Germany. Besides chemists and biochemists, the list includes physicists, biologists and geologists. The applications dealt with fall into such diverse fields as mining, manufacturing, agriculture, nutrition and sanitation.

Volume I treats of the theoretical aspects of colloid science. The individual chapters are quite independent of one another and as a rule concerned chiefly with the special research interests of the writers. They are therefore authoritative, but in many cases rather more largely polemics than critical reviews of broad subdivisions of the general subject. This is to be expected and in fact constitutes the chief merit of such an elaborate collaborative enterprise in a field of knowledge which is still distinctly amorphous. In his preface, however, the editor implies that this is the first "comprehensive treatise," "advanced text or reference work," in which "attention has been given to covering every important theoretical aspect." This does a considerable injustice to the monumental labor of Freundlich and to such writers as Ostwald, Zsigmondy, Bancroft and Svedberg. Moreover, there are a number of important theoretical aspects that receive no attention at all or at best a very inadequate treatment. One could reasonably expect an advanced text book to contain sections dealing at some length with such topics as the formation of the colloid particle, methods of determining particle size and size distribution and the influence of these factors on the properties of the systems, the behavior of the particle in the electric field, the optical properties of colloids, and the characteristics of nonaqueous colloids. The subject index contains no reference to dialysis, ultramicroscopy or ultrafiltration, and the inorganic colloids receive much less attention than their theoretical importance warrants. However, it would be unfair to expect a book of this nature to cover the subject completely. Its usefulness consists mainly in supplying in a condensed and convenient form the viewpoints of a large group of prominent men in the fields to which they have themselves made notable contributions. This the present volume has done in most admirable fashion.

Volume II treats of the practical applications of colloid science. Here the co-operative method of text book writing proves eminently satisfactory. The chapters are well written by men in close touch with their respective fields. In several cases one feels that the author has had to leave out much valuable information in order to confine his chapter to a reasonable length, but on the other hand nearly all the chapters contain copious references to previous publications. Together with the five reports of the British Association, the report of the Faraday Society and a half dozen well-known books on various special subjects, this volume fills out a rich and varied literature on the applied field. The student seeking inspiration for research and the industrial worker looking for aid in the solution of his problems will alike find an abundance of material in these volumes.

F. L. BROWNE.

U. S. Patents Issued Oct. 14, 1924

Nozzle for Atomizing Molten Metal. John H. Calbeck, Joplin, Mo., assignor to the Eagle-Picher Lead Co., Cincinnati, O.—1,511,215.

Tunnel Kiln. William Lee Hanley, Jr., Bradford, Pa.—1,511,218.

Method for Treating Material. Philip A. Singer, Glenellyn, Ill.—1,511,238.

Method of and Apparatus for Refrigeration and Preserving Perishable Products. Thomas B. Slate, New York, N. Y.—1,511,306.

Process of Making Cement and Byproducts. Edwin C. Eckel, Washington, D. C.—1,511,323.

Process for Dyeing Wool With Dyestuffs Capable of Being Chromed. Paul Onnertz, Berlin-Wilmersdorf, and Alfred Peters, Berlin, Germany, assignors to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany.—1,511,359.

Dyeing Apparatus. William A. Traver, Providence, R. I., assignor to Franklin Process Co., Providence, R. I.—1,511,380.

Process of Treating Sewage Sludge. Angus Maclachlan, Perth Amboy, N. J., assignor to Maclachlan Reduction Process Co., New York, N. Y.—1,511,418.

Apparatus for Treating Liquid. Harvey H. Miller, Canton, O., assignor to the H. H. Miller Industries Co., Canton, O.—1,511,421.

Process for Making Finish-Coat Putty. William T. Doyle, Boston, Mass., assignor to Sturtevant Mill Co., Boston, Mass.—1,511,446.

Rosin Manufacture. Frank E. Greenwood, New Rochelle, N. Y., assignor to Pine Waste Products, Inc., New York, N. Y.—1,511,461.

Decolorizing and Purification of Saccharine Materials. John James Hood, London, John Clark, Essex and Percy George Clark, London, England; Rosina Brown Quin, administratrix of the said John James Hood, deceased.—1,511,472.

Construction Material. Kenneth B. Howell, Millburn, and Clarence R. Eckert, Englewood, N. J., assignors to The Barrett Co., N. J.—1,511,475.

Process for Making or Concentrating Hydrogen Peroxide. Gustav Baum, Carinthia, Austria, assignor to the Firm of Chemische Fabrik, Weissenstein G. m. b. H., Carinthia, Austria.—1,511,494.

Process of Making Plaster Board. Harry E. Brookby, Evanston, Ill.—1,511,500.

Refractory Mortar and Cement Composition. Charles G. Carlstrum, Lakewood, O.—1,511,503.

Refractory Mortar and Cement Composition. Charles G. Carlstrum, Lakewood, O.—1,511,504.

Catalyst and Process of Making the Same. William H. Rees, Berkeley, Calif.—1,511,520.

Kiln Construction. Enoch P. Stevens, Chicago, Ill.; Mary Ann Stevens, executrix of said Enoch P. Stevens, deceased.—1,511,535.

Method of Forging Ingots, Billets and the Like. Ivor D. Thomas, Cleveland Heights, O., assignor to the Wellman-Seaver-Morgan Co., Cleveland, O.—1,511,540.

Cleaner for Glass Pots. William Westbury, Independence, Kan., assignor to Laura Anna Westbury, Independence, Kan.—1,511,550.

Reversible Pot. William Westbury, Independence, Kan., assignor to Laura Anna Westbury, Independence, Kan.—1,511,551.

Tool. Victor Yngve, South Orange, N. J., assignor to Manhattan Electrical Supply Co., Inc., New York, N. Y.—1,511,555.

Process of Making a Double Salt of Sodium Fluoride and Sodium Sulphate. Henry Howard, Cleveland, O., assignor to the Grasselli Chemical Co., Cleveland, O.—1,511,560.

Process of Making Artificial Cryolite. Henry Howard, Cleveland, O., assignor to the Grasselli Chemical Co., Cleveland, O.—1,511,561.

Process of Recovering Tin From Tin-Bearing Materials. William J. Buttifield, North Plainfield, N. J., assignor to Vulcan Detinning Co., Sewaren, N. J.—1,511,590.

Liquid-Sampling Apparatus. John C. Colligan, Dallas, Tex., assignor to the Texas Co., New York, N. Y.—1,511,591.

Dome Cover for Tank Cars. Will K. Holmes, Tulsa, Okla., assignor to the Texas Co., New York, N. Y.—1,511,610.

Apparatus for Treating Sugar. Bruno C. Lechler, Philadelphia, Pa., assignor of one-half to Fletcher Works, Inc., Philadelphia, Pa.—1,511,619.

Dust Insecticide and Method and Apparatus for Making the Same. Henry K. McConnell, Richmond, Va., asignor to Tobacco Byproducts & Chemical Corp., Louisville, Ky.—1,511,623.

Process of Making Carbonyl Halide. Victor M. Weaver, Thorold, Ont., Canada, assignor to Weaver Co., Milwaukee, Wis.—1,511,646.

Process of Making Fiber for Paper, Etc. Viggo Drewsen, Brooklyn, N. Y., assignor to West Virginia Pulp & Paper Co., New York, N. Y.—1,511,664.

Treatment of Acid Sludge. William N. Davis, Oakland and George A. Davidson, Berkeley, Calif., assignors to Standard Oil Co., San Francisco, Calif.—1,511,721.

Gas-Distributing Apparatus. Glenn O. Carter, New Rochelle, N. Y., assignor to the Linde Air Products Co.—1,511,752.

Process for Manufacturing of Propantriol From Sugar. Wilhelm Connstein, Berlin, and Karl Ludecke, Wilmersdorf, near Berlin, Germany.—1,511,754.

Method of and Apparatus for Screening Paper Stock. Anton J. Haug, Nashua, N. H., assignor to Improved Paper Machinery Co., Nashua, N. H.—1,511,759.

Explosive Compound for Primers and Detonators. Hans Rathsburg, Furth, Germany.—1,511,771.

Fuel-Feeding Mechanism. Harry F. Smith, Dayton, O., assignor to the Gas Research Co., Dayton, O.—1,511,782.

Plastic Composition. Jakob Sulser, Basel, Switzerland, assignor to the Society Elektrizitatswerk lonza, Gampel and Basel, Switzerland.—1,511,784.

Method of Treating Pulp to Improve Filtration. Urlyn Clifton Tainton, Johannesburg, Transvaal, South Africa.—1,511,785.

Process for Converting Cellulose and Cellulose-Yielding Matter Into Dextrine and Glucose. Henri Terrisse and Marcel Levy, Geneva, Switzerland.—1,511,786.

Manufacture of Hudrogen by Partial Liquefaction of Gaseous Mixtures. Georges Claude, Paris, France, assignor to Société l'Air Liquide (Société Anonyme pour l'Etude et l'Exploitation des Procèdes Georges Claude), Paris, France.—1,511,800.

Modified Milk and Process for Making the Same. George Grindrod, Oconomowoc, Wis., assignor to Carnation Milk Products Co., Oconomowoc, Wis.—1,511,808.

Storage Battery. Rufus N. Chamberlain, Chicago, Ill., assignor to Gould Storage Battery Co., New York, N. Y.—1,511,826.

Method of Making Metallic Beryllium. Sheldon J. Dickinson, Dundee, Ill.—1,511,829.

Heat-Exchange Apparatus. Karl Muhleisen, Philadelphia, Pa., assignor to Schutte & Koerting Co., Philadelphia, Pa.—1,511,836.

Method of Temperature Control in Chemical Reactions. Graham Edgar, Washington, D. C., assignor to United States of America, as represented by the Secretary of War.—1,511,875.

Process of Producing Salts of Ammonia. Ragnar Sandahl, Stockholm, Sweden, assignor to Oscar Ludvig Christenson, Stockholm, Sweden.—1,511,912.

Hypnotic. Ludwig Taub, Ludwig Schutz, and Kurt Meisenburg, Elberfeld, Germany, assignors to Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,511,919.

Manufacture of Phosphoric Acid. Horace Edward Alcock, Luton, England, assignor to B. Laporte Limited, Luton, England.—1,511,929.

Production of Plastic Materials and the Product. Frederick James Commin, London, England.—1,511,949.

Treatment of Tin-Plate Scrap. Roy Algernon Holland, Coburg, Victoria, Australia.—1,511,967.

Method of Treating Rubber. Ellwood B. Spear, Akron, O., assignor to the Goodyear Tire & Rubber Co., Akron, O.—1,511,984.

Method of Pulverizing Horn. Franz Thomas, Barmen, Germany.—1,511,987.

Viscosimeter. Clifford M. Larson and Carl L. Knopf, Chicago, Ill.—1,511,998.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met." readers. They will be studied later by "Chem. & Met.'s" staff, and those which, in our judgment, are most worthy, will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

News of the Industry

Summary of the Week

Tariff Commission conducts preliminary survey of glue in connection with application for higher duty made by domestic manufacturers.

Franco-German commercial treaty not to include stipulation that Germany fill her phosphate requirements from Morocco.

Helium-producing plant at Fort Worth will operate at maximum capacity which the gas supply will allow.

Directors of British Dyestuffs Corporation expected to resign because of failure to gain support for agreement with German cartel.

Committee representing the Manufacturing Chemists Association will attend the conference on forest products at Washington, Nov. 19 and 20.

Dr. Hugh K. Moore, of the Brown Co., Berlin, N. H., has been selected as the next Perkin medalist.

Production of Helium Will Be Kept at Maximum

While the helium repurification plant at Lakehurst has been operated with entire satisfaction to the navy, the Bureau of Mines has replaced the secondary liquefiers with primary purifiers, a development expected to result in increased efficiency. The primary purifiers will be put in immediate use in the preparation of gas for the Los Angeles. The exact amount of improvement that will result from the new apparatus has not been determined, as the need for pressing it into service has been such as to preclude the working out of precise data.

The army is co-operating with the navy in a very whole-hearted way in connection with the experimental program with lighter-than-air craft. The War Department has foregone its claim to the Los Angeles and has loaned the navy the helium needed to complete the total necessary to fly the newly acquired ship. While the 2,000,000 cu.ft. now being shipped from Fort Worth to Lakehurst does not fill the ship to capacity, it will be sufficient for most uses to which the ship will be put in the near future.

With two large ships to supply, the producing plant at Forth Worth will be kept in operation at the maximum capacity which the supply of gas will permit. Due to the fact that the petroleum field is failing, it now will be possible for the plant to process more gas than is available, despite the fact that the entire production of that field now is being stripped of its helium.

To those interested in helium it is a matter of very great satisfaction that arrangements have been made to use helium instead of hydrogen in the Los Angeles. Due to the fact that it is a later ship it has numerous features not embodied in the Shenandoah. The manipulating possibilities of the Los Angeles are much superior to the Shenandoah, it is said. For this reason it can be used to greater advantage in many tests.

Honor for Dr. Moore

Hugh K. Moore, of the Brown Co., Berlin, N. H., has been selected as the next Perkin medalist. Dr. Moore is a chemical engineer of wide reputation and has contributed notably to our knowledge of the manufacture of chlorine and caustic soda, of paper production and to the study of many unit processes. His latest work, on evaporation, was presented within the last year.

Symposium on Corrosion at Baltimore Meeting, A.C.S.

At the Baltimore meeting of the American Chemical Society, which will be held during Easter week, 1925, the Division of Industrial and Engineering Chemistry will hold a symposium on Corrosion. The tentative outline of the symposium is as follows:

1. Submerged Corrosion of Metals.
   a. Iron and Steel.
   b. Non-ferrous Metals.
2. Atmospheric Corrosion.
3. Corrosion of Special Alloys.

It is hoped that the scope of the papers of this symposium will cover the problems of corrosion in the heavy chemical industry, the special chemical industry, the marine world, ordnance equipment, the oil industry, the mining industry, etc. Papers relating to any of these subjects or subdivisions will be welcomed by the chairman of the symposium, Robert J. McKay, International Nickel Co., 67 Wall St., New York City.

Authors planning to present a paper before this symposium should correspond at once with Mr. McKay or the secretary of the division, Erle M. Billings, Eastman Kodak Co., Rochester, N. Y.

Tariff Commission Conducts Survey of Glue

A preliminary survey of glue is being conducted by the chemical staff of the Tariff Commission in connection with the application of the National Association of Glue Manufacturers for an increase in duty under the flexible provisions of the tariff act.

This survey does not involve field work, the object being purely advisory to the commission in determining whether an investigation under section 315 of the act shall be undertaken. This is the internal routine of the commission in all flexible tariff cases. It probably will be 6 weeks or more before the commission decides its disposition of the application, as numerous cases are ahead of the glue application.

Available statistics show that while importations of animal glue are increasing, the totals still are not far in advance of imports during pre-war years. Total imports in 1923 were about 7,250,000 lb., and the 7,000,000 lb. figure was reached before the war. Imports thus far in 1924 appear slightly in advance of those of last year. Domestic production last year was approximately 104,000,000 lb., so that imports were less than 7 per cent of production. England, Holland and Germany, in the order named, have been the principal exporters to the United States in recent months.

Invoice prices do not disclose that foreign glue is being imported at very low prices, the average last year being 8.9c. per pound, to which must be added duty, marine transportation and insurance. Prices of the domestic product last year ranged from 11c. upward.

Unless the inquiry of the Tariff Commission develops facts not apparent on the surface, it is not likely that the commission will order an investigation under the flexible tariff.

Paint and Varnish Associations Elect Officers

Annual meetings have just been held by the National Varnish Manufacturers Association, the Paint Manufacturers Association of the United States and the National Oil Paint and Varnish Association. In each case officers were elected for the ensuing year. The varnish manufacturers elected S. B. Woodbridge president, Charles J. Roh first vice-president, L. Valentine Pulsifer second vice-president, George Heckel secretary.

Newly elected officers of the paint manufacturers are D. A. Kohr, of Lowe Bros., president; L. P. Moore of Benj. Moore & Co., first vice-president; Charles R. Cook, of the Cook Paint & Varnish Co., treasurer.

Edward V. Peters is the new president of the National Paint, Oil and Varnish Association. He is general sales manager of the New Jersey Zinc Co. Other officers are: Vice-presidents, J. Silbey Felton, Philadelphia; R. B. Robinette, Cleveland; George W. West, Atlanta, Ga.; Percy N. Carter, Seattle, and W. B. Ramsey, of Montreal. D. W. Figgis, of New York, was re-elected treasurer.

Service Laboratory Advocated for Every Industry

Every industry should have its service laboratory, Dr. H. E. Howe declared in the course of an address before the Associated Industries of Massachusetts in Boston, Oct. 23. Such a laboratory, he said, is not a luxury, but an absolutely essential safeguard. To illustrate his point, he cited how carefully planned and tenaciously pursued research had developed such a superior automobile varnish as to precipitate a very serious situation for other manufacturers of such varnishes through the sudden loss of a very considerable proportion of their market. The part that chemistry plays in finding profitable uses for by-products is an old story, Dr. Howe declared, but its use in improving quality and in developing new products is not being utilized to the extent necessary to keep pace with the progress being made in other directions.

I.C.C. Ruling on Freight Rates for Acids

The Interstate Commerce Commission has ruled against the contentions of the National Zinc Co. as to the unreasonableness of freight rates on sulphuric, nitrating and muriatic acids from Kansas City to destinations in Kansas and Texas. The commission did find, however, that the rates to Oklahoma points are unduly prejudicial to the National Zinc Co. and unduly preferential to its competitors at St. Louis, Chicago, Peoria, East St. Louis and other points, to the extent that the rates may exceed specified differentials on like traffic from the other points. Proposed reductions in the freight rates on tin, terne and black plate from Pittsburgh to Texas Gulf ports are not justified.

Early Disposal of Muscle Shoals Power Advocated

Prospective Delay in Settling Whole Problem Causes Hope for Separate Consideration of the Power Question

Withdrawal of the Ford bid for Muscle Shoals has given rise to the hope in some official quarters and among the representatives of the industries concerned that Congress may be prevailed upon to allow the disposition of the power to be made by the Federal Power Commission or by the Secretary of War. In this connection it is pointed out that the Ford offer was the only one that has a political aspect. The other offers can be weighed definitely and their respective value determined, but this is a matter of technical determination which can be done best by an administrative rather than a legislative agency.

The thought which has been given the matter since the announcement of Mr. Ford's intention has resulted in an almost unanimous conclusion that the final determination of the whole problem by Congress will result in long delay. Not only would this delay prevent the utilization of the power for a long period after it had been made available, but a far greater difficutly is presented in the state of uncertainty in which the Southern power companies would be left. Ever since the Muscle Shoals project was begun these companies have been faced with a most difficult situation. They have been confronted on one hand with a rapidly compounding demand and on the other hand by the uncertainty as to the steps which they should take to meet the demand. If the power to be developed at Muscle Shoals were going to be made available for general distribution, it was apparent that it would not be in the interest of these utilities, or of the public, to proceed with the development of projects that would not be needed for some years hence if the power at Muscle Shoals were to be made available to the public.

Power Companies in a Quandary

This state of uncertainty has now reached an acute stage. The Alabama Power Co., for instance, cannot determine a policy as to the development of the Talapoosa until the disposition of the Muscle Shoals power is known. It will be a matter of very general concern in half a dozen states if this period of uncertainty must extend for another 2 years. To avoid that the trend of opinion seems to be toward allowing the whole problem to go to the Federal Power Commission. Congress worked for 10 years in an effort to perfect the water-power act. That statute is filled with safeguards looking to the protection of the public, but since the matter of fertilizer is involved it would be a comparatively simple task for Congress to direct the Federal Power Commission to reserve a certain amount of the power to be utilized for that purpose. If there were any other special conditions which Congress wants observed they could be embodied in the legislation. It is recognized that such a bill could pass, particularly if it had the support of the administration.

The only other alternative that will permit of an early removal of uncertainty would be to vest the responsibility for the disposition of the power in the hands of the Secretary of War. Secretary Weeks, himself, doubts that Congress would be willing to do this. In that connection, he did make it clear that he would not hesitate to make temporary disposition of any portion of the power for which he could find a bidder. It is believed, however, that there will be no temporary market for more than 30,000 kw., which is the capacity of the only transmission line connecting Muscle Shoals with its tributary territory. This simply would be a substitution of hydro-power for an equivalent amount of power now being transmitted from the steam plant at Sheffield.

Reasons for Ford Withdrawal

One of the reasons thought to have been responsible for the withdrawal of the Ford offer was the realization that the No. 2 nitrate plant could not be used for the manufacture of fertilizer. Whatever may be done at Muscle Shoals in the way of fertilizer making will require the erection of entirely new plants, it is believed. Incidentally, this has a bearing on the power situation, since the power companies, knowing that a considerable period must elapse before any power will be needed for fertilizer production, will not hestitate to take power with a fertilizer string attached to it.

There is an increasing tendency to think that the power and the fertilizer interests at Muscle Shoals should be divorced. It is becoming more and more evident that great difficulties confront the commercial manufacture of fertilizer at Muscle Shoals.

Morocco May Not Monopolize German Phosphate Trade

Latest advices from Paris indicate that the chances are against the inclusion in the Franco-German commercial treaty of a stipulation that Germany take her phosphate requirements from Morocco. While great care is being taken to keep secret all of the matters being discussed at the conferences on the treaty, the general impression is that the French do not consider phosphates sufficiently important to be placed on a contingent basis, which would require a reciprocal concession. The probabilities are that the French have more important cards to play than those relating to phosphate.

From what is known of the German agricultural situation it is believed that one of the last things the Germans would do would be to agree to take phosphates at any advance over the world price. The probabilities are that the Moroccan producers will not be in a position to meet the price at which American shippers are in a position to lay down phosphate at German ports.

Washington News

Death of Brandegee May Have Bearing on Cramton Bill

The action of American Engineering Council in voting to oppose the Cramton bill, calling for a separate bureau of prohibition in the Treasury Department, is expected to have particular influence in the Senate because of the absence of any commercial interest in the matter.

The situation in regard to that legislation has been altered importantly by the death of Senator Brandegee, the chairman of the Committee on the Judiciary. Senator Brandegee was known to have been thoroughly in sympathy in having the bill recommitted. It is feared that Senator Borah, who probably will succeed to the chairmanship of the Judiciary Committee, may not be willing to lead the fight for the withdrawal of the bill from the Senate calendar.

Twelfth Supplemental List of Dye Standards

The Treasury Department has issued its twelfth supplemental list of standards of strength of coal-tar dyes for the purposes of administering the tariff act. This list adds fourteen colors, names six others for similitude and makes several corrections in lists previously announced. The list of standards is used in assessing the specific duty of 7 cents per pound, which is based upon the ratio that the strength of the importation bears to the strength of similar commercial imports prior to July 1, 1914.

Increased Output of Linseed Products in 1923

The Department of Commerce announces that, according to the data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of linseed oil, cake and meal reported a total output valued at $113,221,318, of which amount $76,751.818 represents linseed oil, $29,259,243 linseed cake and meal and $7,210,257 other products, consisting chiefly of oils other than linseed. The rate of increase in the total value of products as compared with 1921, the last preceding census year, was 59.4 per cent.

The statistics refer only to the output of those establishments that were engaged primarily in the manufacture or refining of linseed oil for the trade, and do not, therefore, cover the value of such oil made and consumed by the same establishments in further processes of manufacture—for example, in the manufacture of paint and of linoleum—nor the output of linseed oil, cake and meal as secondary products by establishments classified in the paint, linoleum and certain other industries. The total value of such commodities thus produced outside the linseed-oil industry in 1921 was $3,002,687, an amount equal to 4.2 per cent of the total value of products reported for that industry. The corresponding value for 1923 has not yet been ascertained, but will be shown in the final reports of the present census. The quantity of linseed oil produced by all classes of establishments has, however, been ascertained through the Census Bureau's quarterly canvass of producers of animal and vegetable fats and oils. According to the returns from this canvass, the total output of linseed oil during the calendar year 1923, including that made and consumed in the same establishments, amounted to 653,563,870 lb.

Freight Rates on Fertilizers Under Attack

Freight rates on fertilizers and fertilizer materials from and to points in Central Freight Association territory have been attacked by the National Fertilizer Association. A complaint filed with the Interstate Commerce Commission contends that the present rates are unreasonable to the extent that they exceed 75 per cent of the existing rates. The complaint also covers rates on acid phosphate and phosphate rock from producing points in Tennessee. It also is contended that the minimum carload weight should be 40,000 lb. instead of 30,000 lb.

Rates on fertilizer and fertilizer compounds from Little Rock to destinations in Oklahoma, attacked by the Arkansas Fertilizer Co., have been found unreasonable. The Interstate Commerce Commission has prescribed reasonable carload rates for the future. In the same opinion reasonable rates also were prescribed for carload and less than carload shipments from Little Rock to points in Texas.

Increased rates on chloride of zinc from Chicago and St. Louis to destinations in Arkansas have been found justified by the Interstate Commerce Commission.

Valuable Algerian Phosphate Open for Exploitation

In a report from Algiers, Vice-Consul D. C. Elkington states that all the phosphate deposits in Algeria are being actively worked, except those of the Djebel-Onk, which are perhaps the most important. They were discovered more than 20 years ago, but are still without transportation facilities, owing to the lengthy discussions which the construction of the necessary railroad has brought about. These deposits are conservatively estimated to contain about a billion metric tons. They are 100 kilometers (6,221 miles) south of Tebessa, Algeria, and 10 kilometers from the Tunisian border. They are 300 kilometers from Bona, the nearest Algerian port, and but 200 kilometers from the Tunisian port of Oabes.

The beds are from 30 to 60 meters thick and are free from either silica or calcareous clay. They are about 3 kilometers wide and 10 long. Every 300 or 500 meters they are cut by ravines, which will permit their exploitation by "quarry" methods for several centuries.

The purity of the product is sometimes above 80 per cent, though it varies generally from 60 to 69 per cent. It is conceded that 500,000,000 metric tons is about 66 per cent pure. Traces only of iron and aluminum have been found. The absence of silica will render the crushing easy to accomplish, and the freedom from water will obviate the necessity of drying.

As the Djebel-Onk exploitation stands now, the successful bidder—that is, the one who promises the largest returns to the colonial government for the concessions—will have to finance the building of the railroad from the deposits to Tebessa, whence the shipments will be carried to seaboard at Rona, Philippeville or some other port. Much doubt has been expressed that the government will find anybody who will make a bid on those terms, so the question may have to be taken up again in the Algerian Financial Delegations and Superior Council, and perhaps in the French Parliament also, in order to change the present law.

Natural Indigo Crop of Japan Reduced by Drought

The Japanese dye market has been inactive, as the textile mills have been operating on part time and purchasing only for current requirements, according to a report from the consular office at Tokyo. The Germans, in order to maintain their hold upon the market, have been selling at prices too low to be profitable, despite a 15 per cent increase in April to offset increased production costs and the adverse exchange rate. The limitation of imports has not as yet operated to raise prices, since the demand is slight and large stocks were imported before the restrictions went into effect.

In spite of the strenuous efforts of the Japanese to establish a dye industry of their own, the Germans still control the market and are so firmly established that it will be some time before they give ground to any great extent.

Indigo presents a condition even worse than that of general dyestuffs. The German merchants have persistently lowered prices and others have had to sell at unprofitable prices or be driven out of the market.

The crop of domestic natural indigo, which it was thought would amount to about 5,000,000 yen for this year, is now estimated at about 1,500,000 yen, due to the drought, which was felt most severely in western Japan. This has served to strengthen the position of natural indigo to some extent, though the tendency is weakened by slack demand.

Coke Freights Reasonable

Freight rates on coke from Portsmouth, Ohio, to Wingate, Ind., which had been attacked by retailers, are reasonable, the Interstate Commerce Commission has ruled.

News in Brief

Refrigeration Engineers Will Meet at New Orleans—The fifteenth annual convention of the National Association of Practical Refrigeration Engineers is to be held in New Orleans, Nov. 11 to 14. A program replete with professional and technical discussions will be included for the 4 days and the entertainment committee has otherwise provided an interesting program. Reduced railroad rates on the certificate plan are announced. The educational exhibition will be one of the most interesting and complete ever put on at one of these conventions.

Large Deposits of Gypsum in Nova Scotia—Experts employed by the Canadian Pacific Railway to examine resources along its lines in Nova Scotia report an undeveloped deposit of exceptionally high-grade gypsum, most favorably located for development and shipment, on Shubenacadie River, having a measurable tonnage of 200,000 tons, and probably several further million tons of commercial gypsum. The quantity of gypsum quarried in Nova Scotia last year was more than 300,000 tons, compared with 256,000 tons in the previous year. Considerable quantities of gypsum have been sold lately to the countries of South America, Cuba, Japan, Australia and the United States.

Railway Company Installs Coke Ovens—The Winnipeg Electric Railway Co., which owns the franchise for the supplying of gas to the city, has installed a battery of Koppers gas and coke ovens, with a production capacity of 2,500,000 cu.ft. of gas daily and with a coal consumption of 200 tons.

Canadian Chemical Company to Be Liquidated—Charles H. Collins, of Toronto, has been appointed permanent liquidator of Chemical Products, Ltd. Apart from the mortgage on the plant, claims total about $40,000. At the close of the war the company took over the large munition plant at Trenton, valued at about $1,500,000, and has manufactured chemicals and fertilizers. The present voluntary winding-up is made pending re-organization.

Bust of Admiral Melville Will Be Presented to Engineers—Presentation of a bust of Admiral George Wallace Melville will be made to the American Society of Mechanical Engineers by a group of his friends at the annual business meeting of the society on Wednesday afternoon, Dec. 3. The bust, which is the work of Samuel Murray, a sculptor of Philadelphia who was a warm personal friend of the Admiral, was approved by Melville before his death. It has been purchased by the subscriptions of none but the Admiral's personal friends.

To Show Application of Chemistry to Trenton's Industry—The School of Industrial Arts, Trenton, N. J., Prof. Frank F. Frederick, director, has arranged for a series of twenty lectures at the institution, dealing with the application of chemistry in local industries. With a nominal entrance fee, the course will be open to technical men, executives, superintendents, foremen, salesmen and others connected with plants in Trenton. The first lecture was given on Monday evening, Oct. 20, and others will be held on this same evening of each week until the course is completed. The different lectures will set forth the chemical principles underlying the processes of converting materials into finished products in the line of rubber, ceramics, petroleum, paints and varnishes, cellulose products, explosives, etc. The staff of lecturers will include Prof. William Foster, Princeton University; E. Rowland Major, general chemistry, S.I.A.; Maurice F. Brandt, A.S., a graduate in chemistry at M.I.T., and Sidney R. Dodd, industrial chemist.

Sugar Interests Form Organization—In connection with the recent Pan-Pacific Food Conservation Conference at Honolulu, Hawaii, a permanent organization of sugar interests was perfected, to be known as the World's International Conference of Sugar Experts. The first meeting was held during the conservation conference, and others will convene in the future once every 3 years in some sugar-producing country. The objects of the new organization are primarily of a technical character, dealing with such matters as cane breeding, elimination of and preventives for cane diseases, methods and means of increasing production, etc.

Pottery Plant in Receiver's Sale—The Knowles, Taylor & Knowles Co., East Liverpool, Ohio, manufacturer of semi-vitreous chinaware, has acquired the plant of the Homer Knowles Pottery Co., Santa Clara, Calif., at a receiver's sale. The plant has never been run, except for a few initial trial schedules. It was built in 1921-22 by H. Harold Knowles of East Liverpool, and was thrown into a receivership more than a year ago. The new owner will take immediate posession and will operate the pottery for the same line of ware as produced at its East Liverpool plants.

Plant Finds Optimism in Europe—Robert Plaut, treasurer of Lehn & Fink, Inc., recently returned from a short visit to Europe, where he visited England, France, Holland and Germany. Mr. Plaut, basing his opinion on interviews with persons of authority and on his own observations of industrial activities, believes that a strong current of optimism prevails and that in spite of England's momentary labor troubles and the shortage of capital in Germany a period of prosperity and improved conditions is expected to follow the new financial arrangements now being made. Following the increased production that will naturally ensue, the United States may feel sharp competition, which will have to be met here by renewed efforts on the part of domestic manufacturers to cut costs to meet the new conditions.

Chemists to Attend Conference on Forest Products

The Manufacturing Chemists Association expects to participate actively in the forest products conference to be held in Washington Nov. 19 and 20. On that occasion the association will be represented by a committee composed of E. H. Hooker, Dr. Charles L. Reese and Dr. M. C. Whitaker. Processes of wood distillation are regarded as particularly inefficient and it is believed that means can be found readily for improving practice in this industry.

Naval Stores Classifier Finds Rosin Misgraded

Misgrading was found in six out of seven lots of rosin recently examined in New York by a classifier and grader under the federal naval stores act, according to the officials of the Bureau of Chemistry, who are charged with the enforcement of that act. The United States naval stores classifier and grader at New York found that from 30 to 96 per cent of the barrels in six of the lots, representing a total of approximately 1,200 bbl. of pale rosins, were misgraded, some of the barrels as much as three grades. Had this misgrading not been detected, the purchaser would have lost from 60c. to $1.50 on each sound barrel misgraded. The grading was done under the naval stores act, which authorizes the Secretary of Agriculture to analyze, classify or grade naval stores upon request and payment of cost by any interested party.

Canadian Firm Takes Large Contract for Newsprint

Announcement is made that Price Bros. & Co. have entered into a contract with the London *Daily Express* for the shipment of a large quantity of newsprint regularly to England. This contract was made, it is understood, during the recent visit to Canada of Lord Beaverbrook, proprietor of the *Express*, and the amount mentioned in newsprint circles as covered by this agreement is in the neighborhood of 15,000 tons. At the present price of newsprint this would aggregate about one million dollars.

British Dyestuffs Corporation Directors Expected to Resign

As understood in Washington the board of directors of the British Dyestuffs Corporation regarded the ruling of the Board of Trade in the matter of the agreement with the German cartel as being tantamount to a vote of lack of confidence. It is expected that the resignations of the members of the board will be accepted and that the conduct of the corporation will be placed in new hands. This is expected to result in another effort on the part of the British industry to stand alone, although the possibility of an agreement with the Germans on other terms has not been precluded, it is believed.

Trade Notes

The annual meeting of the American Association of Textile Chemists and Colorists will be held at the Bellevue-Stratford Hotel, Philadelphia, on Dec. 6.

The Atlantic Tar Products Co. has been incorporated under the laws of New York. Capitalization is $250,000 and incorporators are J. J. Donovan, M. A. Rogers and E. A. Walsh.

A report from Canada says that E. Godfrey, of the Canadian Explosives Co., has been making a tour of inspection of the British Empire Steel Corporation collieries in Cape Breton and in some parts of the mainland, with a view of better adapting the explosives of his company to the blasting of coal in larger sizes.

There will be a monthly meeting of the Salesmen's Association of the American Chemical Industry at the Druachem Club, New York, Tuesday evening, Oct. 28. The speaker of the evening will be George L. Burr, vice-president of the Guaranty Trust Co., whose subject will be "The Cash Value of an Order." In addition there will be a good dinner, music and entertainment. Members may bring guests.

It is reported that the Great West Producers & Refiners, Ltd., of Edmonton, Alta., which was recently incorporated with a dominion charter with a capitalization of $300,000, purposes to build a refining plant at Wainwright. The plant is to have a capacity of at least 400 bbl. of crude oil per day, which will give an output of 200 bbl. a day of lubricants of the different grades. The plant is expected to cost in the neighborhood of $75,000 when completed.

At the annual meeting of the Institute of American Meat Packers held at Chicago last week, officers were elected as follows: President, Oscar G. Mayer, of Chicago; vice-presidents, J. J. Felin, Philadelphia, F. C. Merritt, Indianapolis, Myron McMillan, St. Paul, F. S. Snyder, Boston, and W. W. Woods, Chicago; treasurer, John T. Agar, Chicago.

R. P. Cargille has resigned his position as salesman for the Emil Greiner Co., and has established a selling agency at 74 Cortlandt St., New York, where he will specialize in new products and appliances for the laboratory.

Asbestos Deposits in Ontario

The deposits of asbestos in Delora township, northern Ontario, are promising and already such progress has been made at the Bowman asbestos mine that 60,000 lb. of crude No. 1 asbestos has been shipped, and preparations are being made for the erection of machinery for separating the fiber. In mining circles the opinion has been expressed that this looks like the promising beginning of an asbestos mining industry for northern Ontario.

Favorable Outlook for Belgian Glass Industry

Demand for Belgian plate has been rather accelerated by greater strength of sterling and increased activity on the American automotive industry, and the outlook may, on the whole, be regarded as favorable, according to a report from the Brussels office of the Department of Commerce. Though some similar progress was reported in the window glass market, transactions have been calm in the main with prices uncertain. The mechanical glass plants are better placed. The Société pour l'industrie Mecanique du Verre has just opened a plant with 7 Fourcault machines and after four days trial, operation was classed as normal. The plant is booked for several months ahead. The Glaces Nationales Belges plan to form jointly with related Belgian enterprises a company to be known as the Société de Verreries d'Extreme Orient, which will erect a plant at Haiphong.

Among the hand-made glass plants production exceeded the demand during August though several hilus are idle for repairs. Semi-crystal bottle producers report good business in perfumes for French consumers, but producers of ordinary bottles of small content and the common machine-made line are encountering sharp competition from America, England and the Netherlands.

Nitrogen Fixation Industry of Poland Unsatisfactory

Production of the Polish nitrogen fixation industry is unsatisfactory at the present, according to reports from German sources. Inland demand is short and export markets can not be expanded against German competition. The Polish air fixation industry centers in the Chorzow calcium cyanamide plant, built by the German Government in 1915-16 and lost with the partition in June, 1922.

The most favorably situated markets for Polish nitrogen products are Germany and Czechoslovakia. The former market is extremely unpromising, Germany having sold abroad 10,000 tons of cyanamide and 119,000 tons of ammonium sulphate in 1923, after supplying home demands.

With the Polish partition, a revolutionary shifting occurred in this market. Poland formerly imported from Germany. The Chorzow plant, however, is able to furnish local needs and produces an export surplus. The limestone necessary for the production of carbide was formerly imported from the Oppeln district, but is obtained now exclusively from Polish and Galician resources.

Despite efforts to develop markets in the eastern states and in Italy, these developments are still far from expectations, but the Italian market is still considered as a live possibility. On the other hand, France is said to be placing considerable orders for calcium cyanamide with the Chorzow works. This information was forwarded from Berlin by Trade Commissioner William T. Dougherty.

Financial

The Texas Gulf Sulphur Co., Inc., for the quarter ended Sept. 30, shows net earnings of $1,140,219 after depreciation and federal taxes, but before depletion, equivalent to $1.79 a share earned on $6,350,000 outstanding capital stock. This compares with $1,186,773, or $1.86 a share, in the preceding quarter, and $1,186,515, or $1.86 a share, in the third quarter of 1923.

Directors of American Hide & Leather Co. have decided on a capital readjustment plan, comprising as its main feature the retirement of a substantial amount of the outstanding 125,483 shares of preferred, on which back dividends amount to about 140 per cent, at a price understood to be $70 a share.

The International Salt Co. for the quarter ended Sept. 30, reports earnings of $341,169 after all expenses. Net income after fixed charges and sinking fund, but before federal taxes, was $244,772, comparing with $124,394 in the preceding quarter and $328,562 in the third quarter of 1923.

Latest Quotations on Industrial Stocks

	Month Ago	This Week
Air Reduction	86½	83½
Allied Chem. & Dye	74⅝	71⅝
Allied Chem. & Dye pfd	115½	117
Am. Ag. Chem.	12½	12½
Am. Ag. Chem. pfd.	35¾	35⅝
American Cyanamid	*97	*98
Am. Drug Synd.	5½	5⅝
Am. Linseed Co.	21⅞	18½
Am. Linseed pfd	43½	40½
Am. Smelting & Refining Co.	75⅜	75½
Am. Smelting & Refining pfd.	104	104
Archer-Daniels Mid. Co. w.i.	*20⅝	20
Archer-Daniels Mid. Co. pfd.	*85½	88
Atlas Powder	50	48
Casein Co. of Am.	*67	*67
Certain-Teed Products	38	35
Commercial Solvents "A"	65½	70
Corn Products	35⅜	37
Corn Products pfd	*122	120½
Davison Chem.	50½	45¾
Dow Chem. Co.	*52	*52
Du Pont de Nemours	131½	128½
Du Pont de Nemours db.	90⅜	92¼
Freeport-Texas Sulphur	8¾	9
Gold Dust	*39	37¼
Grasselli Chem.	*124	*124
Grasselli Chem. pfd.	*103	*104
Hercules Powder	*88	*87
Hercules Powder pfd	*104	*104
Heyden Chem.	3	2⅞
Int'l Ag. Chem. Co. (new)	6⅝	5¾
Int'l Ag. Chem. pfd. (ctfs.)	*42	*41
Int'l Nickel	18⅞	19⅛
Int'l Nickel pfd	88	90½
Int'l Salt	*76½	*76½
Mathieson Alkali	40	37
Merck & Co.	63	61
National Lead	158⅝	156
National Lead pfd.	117⅞	117
New Jersey Zinc	*159	162
Parke Davis & Co.	*80	*80
Pennsylvania Salt	*82½	*82½
Procter & Gamble	*109	*109
Sherwin-Williams	*30	31
Sherwin-Williams pfd	*101	*103½
Tenn. Copper & Chem.	7¾	7½
Texas Gulf Sulphur	80⅞	78½
Union Carbide	60⅞	60½
United Drug	91½	96½
United Dyewood	40	*40
U. S. Industrial Alcohol	72¼	72½
U. S. Industrial Alcohol pfd.	*105	104⅞
Va.-Car. Chem. Co.	*1⅝	*1⅛
Va.-Car. Chem. pfd.	4⅝	3½

*Nominal. Other quotations based on last sale.

Men You Should Know About

ERNEST ASHTON, chief chemical engineer of the Lehigh Portland Cement Co., Allentown, Pa., now absent on a business trip to Europe, will return to his office before the close of the month.

E. C. C. BALY, of the University of Liverpool, England, addressed members of the California and South California sections of the American Chemical Society on Oct. 11 and 15, respectively, his subject being "Photosynthesis of Naturally Occurring Compounds."

JAMES S. BLAIR, who completed his work for the Ph.D. degree under Dr. E. C. Franklin, of Leland Stanford, Jr., University, Palo Alto, Calif., has accepted a position in the department of chemistry, Oregon State College, Corvallis, Ore.

EDWARD BREITWIESER is no longer connected with the Dorr Co., but is now with the Phillips Chemical Co., Glenbrook, Conn.

W. K. BROWNLEE, of the Buckeye Clay Pot Co., Toledo, Ohio, gave an address before the Pittsburgh, Pa., section of the American Ceramic Society, Oct. 20 on the subject, "Effect of Insulation on Flux Line Blocks in Glass-Melting Tanks."

HOWARD ECKER, who has been teaching chemistry at the Ohio Mechanics Institute for 6 years, for 3 years of which time he was department head, is now in charge of research for the Johnston Paint Co., Cincinnati, Ohio.

JOHN L. GRAY, vice-president and general manager of the Shaffer Oil & Refining Co., Chicago, Ill., has been elected a member of the board of directors of the Western Petroleum Refiners Association.

ROBERT G. HACKMAN, who since graduation from the University of Kansas has been with Armour & Co. and Procter & Gamble, is now city chemist for Kansas City, Mo.

WILLIAM HATTON, president of the Eagle-Ottawa Leather Co., Grand Haven, Mich., has sailed for Europe on a business trip, to be absent several weeks.

W. G. LINEHAN, of the Canadian Export Paper Co., Ltd., representing Price Bros., Laurentide & Brompton, has been sent overseas to reorganize the London office and establish a permanent sales agency there.

R. A. OSBORNE, who completed his work for the Ph.D. degree under C. W. Foulk in the department of analytical chemistry, Ohio State University, at Columbus, is now with the department of chemistry as instructor in general chemistry at Oregon State College, Corvallis, Ore.

Dr. C. S. PALMER, of Northwestern University, Chicago, Ill., has become connected with the bureau of scientific research of the Institute of American Meat Packers. He will conduct the experimental phases of the work at the University.

JOHN H. PRICE has been elected president of Price Brothers & Co., Ltd., of Montreal, Canada, paper manufacturer, to succeed his father, Sir William Price, who lost his life a few weeks ago in a landslide at the mill of the company at Kenogami. He is the eldest son of the deceased.

HORATIO S. RUBENS, president of the U. S. Industrial Alcohol Co., New York, has been elected chairman of the board of the Cuba Railroad Co., an office recently created.

RALPH SHAFOR, superintendent of the research laboratory, Great Western Sugar Co., Denver, Colo., has been assigned to the Loveland, Longmont and Fort Collins, Colo., plants of the company. He will divide his time among these mills.

Mr. and Mrs. H. N. SPICER, who left this country June 4, arrived home on the Aquitania on Friday, Oct. 24, after visiting Poland, Germany, Austria, Czechoslovakia, Spain and France, on a business survey.

H. A. SPOEHR, of the Coastal Laboratory of the Carnegie Institution, Carmel, Calif., was in Los Angeles recently.

JAMES O. STEIN has established an industrial chemical business at 381 Parsells Ave., Rochester, N. Y., bearing the name of the Stein Chemical Co.

LOUIS STOTZ has resigned his position as assistant secretary-manager of the American Gas Association and will shortly take up his new position as assistant managing director of the "Own Your Home" Exposition, Inc., with headquarters in the Witherspoon Building, Philadelphia.

Calendar

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Smithsonian Institution, Washington, D. C., Dec. 29 to Jan. 3.

AMERICAN ASSOCIATION TEXTILE CHEMISTS AND COLORISTS, Bellevue-Stratford, Philadelphia, Dec. 6.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Hotel Shenley, Pittsburgh, Pa., Dec. 3 to 6.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York, Dec. 1 to 4.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, New York, Dec. 1 to 3.

FOREST PRODUCTS UTILIZATION CONFERENCE, National Museum, Washington, Nov. 19 to 20.

NATIONAL CONFERENCE ON UTILIZATION OF FOREST PRODUCTS, Washington, D. C., Nov. 19 and 20.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, Grand Central Palace, New York, Dec. 1 to 4.

SOUTHERN EXPOSITION, Grand Central Palace, New York, Jan. 19 to 31, 1925.

K. F. VAUGN is consulting engineer for the American By-Products Co. He will make his headquarters at Vancouver, Wash.

J. B. WADDELL has been appointed president of the Canadian Industrial Alcohol Co., Ltd., succeeding J. R. Douglas, who has retired. Mr. Waddell was formerly vice-president of the company.

F. B. WILSON, chemist, has been transferred from the Atlantic Insulated Wire & Cable Co.'s plant in Stamford, Conn., to the plant of the Rome Wire Co. at Rome, N. Y. The equipment of the Stamford plant is now being moved to the new location as a branch of the Rome plant.

DEAN E. WINCHESTER, who was formerly with the U. S. Geological Survey and in that capacity made the first complete report on our oil-shale resources, is now engaged in consulting work in Denver. He has recently removed his offices to 440-1 Steel Building and has announced that he will confine his attention to geological surveys in connection with petroleum, oil shale and coal.

ROLAND WOODWARD, JR., has resigned as development engineer of E. R. Squibb & Sons, New York, to accept a position with E. I. du Pont de Nemours & Co. in Wilmington, Del.

At a symposium at the Pittsburgh, Pa., station of the U. S. Bureau of Mines, dealing with the subject of the importance of chemistry in food product development, Oct. 16, the following speakers gave interesting and instructive addresses: John C. Fetterman, director, National Certification Laboratory, "The Chemist in the Dairy Industry"; H. N. Riles, director of research, H. J. Heinz Co., "The Chemist in the Packed Food Industry"; T. B. Downey, senior industrial fellow, Mellon Institute, "The Chemist in the Edible Gelatin Industry"; and E. S. Stateler, technologist, Hershey Brothers, "The Chemist in the Confectionery Industry."

Obituary

JOSEPH E. ELLISON, chief metallurgist and a director of the Ellison Brass Manufacturing Co. and the Ellison Bronze Manufacturing Co., Falconer, N. Y., died at his home in Jamestown, N. Y., Oct. 11, at the age of 49 years. With his brothers, in 1915, he founded the brass works and later formed the bronze company.

MARK ROGERS, president of the Canadian Oil & Refining Co. of Lethbridge, Alta., Canada, died at his home in Lethbridge recently.

RALPH C. VANCE, manager of the American Paper Products Co., East Liverpool, Ohio, died in a hospital in that city, Oct. 16.

Market Conditions

Firmness in Metals Has Strengthening Effect on Derivatives

Advances Reported for Some Metal Salts With Others Expected to Reach Higher Levels

UPWARD movement of prices for lead, tin, copper, and antimony has had a corresponding effect on the position of the metal salts. Some of the latter went to higher levels last week and in practically all cases steadier markets were reported. The recent advance in tin will result in a higher average price for the present month and this points to an increase in price for bichloride and crystals for November delivery. Some sellers have announced a new schedule for acetate of lead but the advance was not general.

Various rumors have been circulated to the effect that German exporters of caustic potash had again advanced quotations on this chemical. There were sellers, however, at the level quoted in the preceding week and consuming demand has fallen off since the higher prices went into effect. The agreement among these exporters should act as a guarantee against any recession in price but further advances undoubtedly will depend on the readiness of domestic markets to absorb offerings.

The weighted index number for the week was 154.86 as compared with 154.85 for the preceding period. Price changes were within narrow scope with a practical offset between advances and declines. Sales at private terms have decreased in the past month but competition is still keen in a few items with a consequent unsettlement of the quoted price levels.

Arrivals of foreign chemicals are reported regularly and receipts during the current month are reported unofficially to be ahead of the totals for September. The presence of imported chemicals is still a factor in establishing market values and in a few cases they are receiving the bulk of consuming orders.

A report from Washington reveals that the Tariff Commission is conducting a preliminary survey of glues with a view of determining whether an investigation of producing costs shall be undertaken. Domestic manufacturers have petitioned for a higher duty on glues.

Acids

Rather large arrivals of oxalic acid from foreign markets were noted last week and it is evident that the lower prices reached have failed to check competition. In the struggle to hold consuming trade, buyers are benefited and open quotations of 9½c. per lb. are heard. Imported tartaric acid has been weak and buyers can pick up spot holdings as low as 25⅛c. per lb. Present demand for citric acid is light and imported is said to be available at 45c. per lb. Acetic acid is moving fairly well and prices are being sustained. The mineral acid group has been selling freely for prompt delivery and different consuming trades are reported to have been inquiring about distant deliveries with some contracts placed for next year. Prices for the latter have been steady. Producers have been able to work off a good part of stocks which accumulated during the warm weather period. This combined with more consistent movement from works has brought selling pressure to a minimum.

Tin Oxide Advanced 2c. Per Lb.—Acetate of Lead Firmer—Nitrite of Soda in Strong Position—Epsom Salts Lower for Shipment — Prussiates Easy — Selling Pressure Reported for Bichromates—Formaldehyde Firm — Tartaric Acid Unsettled—Barium Salts Unchanged — Caustic Soda Offered at Private Terms

Potashes

Bichromate of Potash—Sellers have been active in keeping offers before buyers and selling tactics have given an easy tone to values. Offerings are generally quoted on a sliding scale with quantity as the deciding factor. Asking prices have ranged from 8½c. per lb. to 9c. per lb. Some producers appear anxious to book orders with at least one producer reported to be curtailing output because of the low prices prevailing.

Caustic Potash — Certain domestic sellers have been holding imported caustic potash at 7¼c. per lb. in the spot market and quotations of 7¾c. per lb. for shipment from abroad also have been widely circulated. However, the market has not changed during the interval and both spot and shipments are offered by leading factors at 7⅛c. per lb. Demand was not active as most consumers are said to be covered for the present.

Carbonate of Potash — Only limited inquiry was heard for carbonate and quotations have been kept on an unchanged basis. Some rumors are heard that this material will be marked up in foreign markets. Current quotations are 5@5¼c. per lb. for calcined 80-85 per cent, 5¾@6c. per lb. for 96-98 per cent, and 5¼@5½c. per lb. for hydrated 80-85 per cent.

Permanganate of Potash—Domestic material is still offered at 12¼@12½c. per lb. and is reported to be meeting with a moderate inquiry. The fact that sellers of domestic have announced their intention to meet competition has aroused interest but this has not yet resulted in heavy buying. Imported permanganate is held at 12½@12¾c. per lb. on spot.

Prussiate of Potash—The easier tone to prices has not stimulated buying in spot material and the market is again reported as quiet. Some consuming industries have not been taking their usual quotas and values have fallen gradually for months. Yellow prussiate on spot was offered at 16½c. per lb. and the same price was given for forward deliveries.

Sodas

Acetate of Soda—Factors continue to quote on a basis of 5c. per lb at works. Spot holdings are reported to be small and 5c. per lb. appears to be an inside figure in all directions. Demand is fair and producers report a good movement from works against old orders.

Bichromate of Soda—Some sellers say new business has been too spasmodic to be regarded as favorable. It is stated, however, that considerable business has been placed for forward delivery but this has not been well distributed as all sellers have not been willing to quote on a uniform level. The market is easy in tone with round lots reported available at 6⅝c. per lb.

Bisulphite of Soda—Recent buying has reduced holdings and the market is in a steady position. Round lots of powdered 60-62 per cent are quoted at 3¾c. per lb. with sales of smaller lots at higher figures. The liquid is moving quietly at 1½c. per lb. for 35-38 per cent.

Caustic Soda—The main feature to the present market is found in reports that domestic consumers have been offered considerable quantities for prompt delivery at 3c. per lb. and slightly under. Leading producers are quoting at unchanged prices of 3.10c. per lb. carlots, at works, on contract, with an advance of 10c. per 100 lb. for prompt shipment. Export business is not active and f.a.s. quotations remain at 2.85c. to 3c. per lb.

Chlorate of Soda—Imported chlorate on spot is in limited supply with hold-

ers asking 6½c. per lb. Shipments from abroad range from 6c. to 6¼c. per lb. Domestic chlorate is offered at 6¼@6½c. per lb. at works.

Nitrite of Soda—Spot holdings of nitrite of soda are in firm hands and 9¼c. per lb. is given as an inside price. Some importers who were prominent in this trade in the past were not quoting. Shipments from abroad also were held at 9¼c. per lb. Domestic nitrite is reported to have sold in a fairly large way on contract at 8½c. per lb.

Prussiate of Soda—The absence of any sustained buying has influenced holders to offer spot material more freely and there were open quotations last week at 9c. per lb. This is said to have been the actual trading basis for some time but the open quotations had been kept at 9½c. per lb. Imported prussiate for shipment was offered at 8¾c. per lb.

Miscellaneous Chemicals

Acetate of Lead—Some producers are reported to be carrying small stocks both of the chemical and of the metal and have advanced prices for all grades of acetate of lead 1c. per lb. In other quarters the old level of prices has been maintained and offerings are available at 14½c. per lb. for white crystals and 13½c. per lb. for brown, broken. Sales of imported white crystals on spot are reported at 13½c. per lb.

Arsenic—Very little interest is reported for domestic arsenic and the quotation of 7c. per lb. is little better than nominal. Imported arsenic is finding a very restricted outlet with holders not attempting to push matters. Asking prices are 6½@6¾c. per lb.

Bleaching Powder — While interest has been shown in deliveries over next year, producers have not yet quoted on 1925 business. The bulk of present business consists of deliveries against old orders and contract withdrawals are of good volume. The quotation on large drums, in carlots, holds at $1.90 per 100 lb. at works. Liquid chlorine also is passing into consumption freely with tanks offered at 4½c. per lb. at works.

Epsom Salts — Buyers have been showing good interest in this material and spot goods have been reduced to small volume. As a result of the restricted offerings prices are being maintained at $1.35@$1.40 per 100 lb. Shipments from foreign markets, however, are offered freely and sellers are quoting as low as $1.25 per 100 lb.

Formaldehyde—Improved call is reported for both carlots and smaller amounts. Producers are more reserved with offerings and in all quarters 9c. per lb. is given as an inside figure for carlots. For smaller amounts a premium is asked and moderate sized amounts are said to have commanded 9½c. per lb.

Sal Ammoniac — Fair inquiry was noted for imported white sal ammoniac on spot and sales went through at 6c. per lb. The latter is a fairly general quotation. Shipments from abroad are offered at 5¾c. per lb. Domestic white sal ammoniac is quoted at 7c. per lb. at works and the gray at 8c. per lb.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	**154.86**
Last week	154.85
Oct., 1923	167.00
Oct., 1922	153.00
Oct., 1921	151.00
Oct., 1920	263.00
Oct., 1919	233.00
Oct., 1918	280.00

Major items in the chemical trade did not move much so far as prices were concerned. Caustic potash was slightly higher and this caused the index number to advance one point.

Tin Oxide—An uplift to the metal market was followed by an upward revision in the price for the oxide and sellers who had been quoting 52c. per lb. put their price at 54c. per lb. No change was made in prices for tin crystals or bichloride of tin but with the metal higher it is expected that an increase in the salts will be made on the first of the month.

Alcohol

No additional changes took place in the market for denatured alcohol in the past week. A firm undertone prevailed in all directions, reflecting small stocks and high prices for raw materials. Demand was good. Special, formula No. 1, is quoted at 55c. per gal., in drums, carload lots. Completely denatured, formula No. 5, held at 54c.

Trading in methanol was inactive and, while prices did not change, the undertone remains barely steady. Production of methanol has been curtailed for some time now, yet stocks are ample. Prices were repeated on the basis of 76c. per gal., in bbl., on the 97 per cent grade. Pure, in tank cars, held at 76c. per gal., works.

Coal-Tar Products

Output of Byproduct Coke in September Shows Gain of 8 Per Cent —Benzene Holds Firm—Pyridine Offered More Freely

PRODUCTION of byproduct coke in the month of September, according to the Geological Survey, amounted to 2,543,000 tons, a gain of 8 per cent over August. The plants operated at 67.2 per cent of capacity. Of the 75 plants now in existence 68 were active and 7 were idle. The moderate gain in production reflects slightly improved conditions in the steel industry. Plants affiliated with iron furnaces produced 2,086,000 tons of byproduct coke in September, or 82 per cent of the total output. As a market factor the gain in production exerted little influence. Production would have to be increased considerably in order to produce a surplus in crudes. At the present time the stocks of ammonium sulphate, benzene and creosote oil are insignificant and prices steady, though quotably unchanged. Phenol was firm, with a fair inquiry in evidence. Naphthalene, refined, was quiet and prices irregular. There were larger offerings of pyridine for immediate and nearby delivery, with prices a shade easier.

Aniline Oil and Salt—Fair trading was reported in aniline oil for domestic consumption and, with stocks moderate, a firm undertone featured the market. Leading makers reported business on the old basis of 16c. per lb., drums extra, carload lots, f.o.b. works. Aniline oil for red was nominally unchanged at 40c. per lb. The market for salt was inactive, with prices nominal at 19@22c. per lb., according to quantity and seller.

Benzene — Producers have experienced no difficulty in disposing of production and in some directions a pronounced scarcity exists in spot material. There has been a slight gain in production, but this did not provide for enough benzene to cause any weakness in the general situation. Leading traders reported conditions unchanged and the market held at 23c. per gal. on the 90 per cent grade, and 25c. per gal. on the pure, tank cars, f.o.b. works.

Creosote Oil—During the past week a cargo of creosote arrived from Antwerp. Foreign markets have been easy on rather liberal offerings. Manchester reported offerings on the basis of 5¼@5½d. per gal., in bulk, point of production.

Cresylic Acid—Domestic producers reported a fair movement in 97 per cent cresylic acid and prices held about steady at 64@68c. per gal., according to color and make. English markets have weakened because of quiet business conditions and there were sellers at 2s. per gal., prompt shipment.

Naphthalene — Trading in refined naphthalene continues along moderate lines, distributors showing comparatively little interest in the market. Prices varied considerably, with some pressure existing on spot in both flake and ball. Some producers endeavored to arouse buying interest in forward requirements, but prices named were above the spot market and this caused prospective buyers to hold off. Nominally the market for flake held at 4¾@5¼c. per lb., carload basis. Crude was available for shipment from England at approximately 2c. per lb., c.i.f. basis.

Phenol—U.S.P. phenol on spot sold at 25c. per lb., in drums, indicating that the market underwent no change in the past week. The undertone was steady, reflecting moderate holdings in the hands of producers. On contract it was possible to do 24c. per lb., large drums.

Pyridine—The spot positions eased off slightly on freer offerings, importations increasing. The market closed at $4.15@$4.25 per gal., immediate and nearby delivery, with $4 named on futures.

Solvent Naphtha—Total production of solvent naphtha in 1923 amounted to 4,162,178 gal. The market in the past week was inactive, but prices were unchanged on the basis of 24@25c. per gal. on the water white, in tanks, f.o.b. works.

Vegetable Oils and Fats

Refined Cottonseed on Spot Higher—Linseed Futures Unsettled—Coconut and Palm Oils Advance—Tallow Strong

THERE was a steady call for edible oils and soap-making materials and higher prices prevailed for prompt shipment refined cottonseed oil, coconut oil, corn oil, the different palm oils, tallow and greases. The drying oils were inactive and some irregularity occurred in futures, especially for linseed oil. Rapeseed oil was higher abroad, and this strengthened sellers' views here. Tallow sold at an advance, with the market strong under good buying by soap makers.

Cottonseed Oil—The market for refined cottonseed oil was slightly higher in all positions. With lard at a substantial premium, the demand for cottonseed oil products improved considerably. October refined oil on the Produce Exchange settled around 11.30 @11.50c. per lb., which compares with 10.95@11.20c. per lb. a week ago. Tenders for 1,900 bbl. of October oil came on the market, but had no depressing influence upon the situation. Trading in the options narrowed down, but with movement of crude not up to expectations the local speculative element did not force matters. Western longs held on to their accumulations, notwithstanding more favorable news from the cotton belt. The Census report for September was favorable on actual disappearance of refined oil, but the fact that the visible increased by 266,000 bbl. over the August figures caused some uneasiness. Estimates on October consumption range from 250,000 to 300,000 bbl. Crude oil for immediate shipment sold at 9c. per lb., tank cars, f.o.b. mills, Southeast. In Texas business was reported at 8¾@8⅞c. per lb., tank car basis. Bleachable oil was nominal at 9⅝c. per lb., in tank cars, f.o.b. Texas common points. Lard in the West was unsettled late in the week, cash Chicago closing at 16.37c. per lb., after selling up to 16.95c. per lb. Lard compound was in good request and leading producers held out for 13¾@13⅞c. per lb., in bbl., carload basis.

Linseed Oil — There was an easier market for futures, reflecting unsettlement in seed values, as well as lack of buying interest on the part of the larger consumers. Spot and nearby oil, however, remained firm, few crushers being in a position to quote on round lots for October-November delivery. In fact several crushers are behind in making regular contract deliveries. Prompt shipment oil closed at $1.05@$1.06 per gal., in bbl., carload basis, with early November at $1.01 and late November at 98c. per gal. December-April oil was nominal, prices ranging from 97@98c. per gal., according to seller. Receipts of new crop seed at Northwestern terminals were larger, but buying was good, competition for nearby seed being quite keen. Prices were somewhat lower than a week ago, due chiefly to unsettlement in other grains. Interest centered in the crop news from the Argentine. Weather conditions there were far from satisfactory and most traders have given up hope for a large yield. While the area sown is estimated officially at 5,906,000 acres, much of the plantings has been abandoned. No official estimate in yield has been issued to date, but private estimates range from 38,000,000 to 42,000,000 bu. The future hinges entirely upon the Argentine crop and a small yield in South America might offset what gains were made in production in the American northwest. Duluth quoted October flaxseed at $2.47 per bu., with December at $2.43¾ per bu. Buenos Aires quoted November option seed at $2.14½ per bu. Cake for export was in demand and firm at $50 per ton, f.a.s. New York.

China Wood Oil—Demand remained quiet and with futures a little more free values fell off in all positions.

Stocks of Cottonseed Oil Increase in September

Distribution of refined cottonseed oil in September was larger than expected, the disappearance, based on official figures, amounting to 157,000 bbl., which compares with 216,000 bbl. in August and 166,000 bbl. in September, 1923. The visible supply of oil on Sept. 30 was estimated at 482,000 bbl., against 467,000 bbl. a year ago. The Bureau of the Census statistics on cotton seed and cottonseed products for the first 2 months of the new season, with a comparison, follow:

	—Aug. 1 to Sept. 30—	
	1924	1923
Seed received, ton	736,064	713,264
Seed crushed, ton	377,332	304,304
Crude oil mfd., lb.	109,678,383	85,651,931
Ref'd oil mfd., lb.	70,073,850	52,827,568
Stocks Sept. 30:		
Seed, ton	380,443	421,746
Crude oil, lb.	44,115,692	34,620,024
Refined oil, lb.	50,343,673	41,649,527
Exports Aug. 1. to Sept. 30:		
Crude oil, lb.	741,785	774,280
Refined oil, lb.	1,531,765	2,335,259

Holders of spot oil were offering at 15¾c. per lb. with nearby deliveries at 15c. per lb. in bbl. Tank cars for shipment from the Pacific Coast were quoted at 14c. per lb.

Corn Oil—Sellers were offering only in a limited way and a very firm undertone prevailed. Crude oil sold on a basis of 10c. per lb. tank cars, f.o.b. Chicago.

Coconut Oil — Advices from Manila revealed a strong market for copra and the latter was quoted at 5⅝@5¾c. per lb., c.i.f. Pacific Coast. Offerings of oil were still reserved but sales of Ceylon type oil went through at 9⅞c. per lb. at New York. Prompt shipment in tanks from the Pacific Coast was firmly held at 9½c. per lb. and December forward was nominal at 9c. per lb.

Palm Oils—Reports from markets abroad indicate a scarcity of palm oils and offerings for shipment were so restricted that importers declared prices to be purely nominal. Lagos oil for shipment was quoted at 9¼c. per lb. but this was by no means a trading quotation. Niger oil for November delivery sold at 8⅝c. per lb. but no prices were named for later deliveries.

Rapeseed Oil—There were sales of English refined oil on spot at 92c. per gal. On forward positions the asking price was 96c. per gal. with buyers showing no interest.

Sesame Oil—The market was quiet with offerings of December-June at 12½c. per lb.

Fish Oils—Reports from the fishing grounds were no more favorable than in the preceding week. Crude menhaden oil was firmly held at 52½c. per gal., tank cars, f.o.b. shipping point. Offerings of untanked Newfoundland cod oil were on the market at 58c. per gal., in bbl., shipment from St. Johns.

Tallow, Etc.—Sales of round lots of extra special tallow went through at 9½c. per lb. which represents an advance of ¼c. per lb. for the week. Yellow grease also was higher in price with 8¼c. per lb. asked. Oleo stearine was offered at 13¼c. per lb. and sales of No. 1 oleo oil were made for export at 22c. per lb.

Miscellaneous Materials

Blanc Fixe — Demand has held up fairly well and large amounts are passing into consumption. Sellers offer the pulp at $60@$65 per ton in bulk and the dry at 3½c. per lb., carlots, in bbl., at works.

Barytes — A good movement from works is reported by domestic producers with prime floated at $22 per ton, f.o.b. western points. Southern works offered off-color at $15 per ton. Imported ranged in price according to grade with $28@$35 covering the range.

Glycerine—Sellers of dynamite were offering freely and were willing to accept 18c. per lb., in drums, carload lots, f.o.b. western producing points. Local sellers were holding chemically pure glycerine at 19c. per lb., drums included. Crude, soap lye, basis 80 per cent was nominal at 12@12½c. per lb., loose, carload lots, f.o.b. works.

Lithopone — Consumption is running to large figures and some producers are said to be using the greater part of their output to take care of contracts. New business is only moderate because most consumers are covered ahead. Producers who have surplus stocks are willing to grant concessions and while 6@6½c. per lb. is quoted for round lots, it is possible to shade the inside figure.

Naval Stores—Steady export buying has strengthened the market for rosin and higher prices were again in evidence. The lower grades are now quoted at $7.35@$7.50 per bbl. Call for turpentine was confined to comparatively small lots and offerings were on the market at 86@87c. per gal.

White Lead—The official price for pig lead was advanced to 8¼c. per lb. at the beginning of last week. Inquiry for lead was active and sales were made at 8.40c. per lb., at New York. The market for the pigments underwent no change but the undertone was firm. Deliveries of white lead and lead oxides are normal with a good call for jobbing lots. Sellers offer standard dry basic carbonate at 10c. per lb., in bbl., carlots.

Imports at the Port of New York

October 17 to October 23

ACETONE — 3 bbl., Rotterdam, H. A. Metz & Co.

ACIDS—Citric—60 csk., Palermo, C. L. Huisking, Inc. **Formic**—80 carboys, Hamburg, Order. **Boracic**—200 bg., Leghorn, Pacific Coast Borax Co. **Oxalic**—42 csk., Christiania, Order; 28 csk., Hamburg, Seaboard National Bank. **Tartaric**—500 csk., Palermo, Order; 50 csk., Rotterdam, W. Benkert & Co.; 600 csk., Palermo, Order. **Stearic**—20 cs., Rotterdam, M. W. Parsons & Plymouth Lab.; 62 pkg., Rotterdam, Ponds Extract Co.

ALCOHOL — 125 bbl. denatured, San Juan, C. Esteva; 150 bbl. denatured, Arecibo, C. Esteva; 24 dr. amyl, Hamburg, Honeywill Bros.

AMMONIUM SULPHATE — 102 bg., Hamburg, Kuttroff, Pickhardt & Co.

ARSENIC—91 bbl., Tampico, American Metal Co.

ASBESTOS — 2,690 bg., Capetown, Standard Bank of New York; 21 bg., London, Asbestos & Mineral Corp.

BARIUM CHLORIDE — 115 csk., Rotterdam, E. M. Sergeant Co.; 66 csk., Antwerp R. W. Greeff & Co.; 49 bbl., Hamburg, A. Klipstein & Co.

BARIUM NITRATE — 43 bbl., Hamburg, Roessler & Hasslacher Chem. Co.

BARYTES — 600 tons, Rotterdam, Ore & Chemical Corp.; 30 csk., Hamburg, A. Hurst & Co.

BLEACHING POWDER—75 cs., Liverpool, H. Kohnstamm & Co.

BRONZE POWDER—25 cs., Bremen, T. Riessner; 41 cs., Bremen, L. Uhlfelder & Co.; 3 cs., Bremen, Order; 2 cs., Bremen, R. F. Lang; 9 cs., Bremen, B. F. Drakenfeld & Co.

CAMPHOR—23 bbl., Hamburg, Order; 160 cs., Hamburg, Equitable Trust Co.; 112 cs., Hamburg, Order.

CASEIN — 1 bg., Copenhagen, Order; 2,218 bg., Buenos Aires, National City Bank; 417 bg., Buenos Aires, Irving Bank-Col. Trust Co.; 833 bg., Buenos Aires, Bank of the Manhattan Co.; 830 bg., Buenos Aires, Bank of London & South Am.; 417 bg., Buenos Aires, First National Bank of Boston; 310 bg., Havre, National City Bank.

CARBON—100 bg. decolorizing, Rotterdam, L. A. Salomon & Bros.

CHALK—551 tons crude, Dunkirk, Taintor Trading Co.; 800 tons do., Dunkirk, J. W. Hegman Co.; 300 bg., Antwerp, National City Bank; 112 bg., London, Chemical National Bank; 750 bg., Antwerp, Order.

CHEMICALS — 218 dr., Hamburg, Roessler & Hasslacher Chemical Co.; 455 dr., Hamburg A. Klipstein & Co.; 40 csk., Bremen, Roessler & Hasslacher Chemical Co.; 50 csk., Rotterdam, Hans Hinrichs Chemical Co.; 20 csk., Rotterdam, Order; 78 demijohns, Hamburg, A. Klipstein & Co.

CHROME ORE—480 tons, Madras, Order; 898 tons, Beira, U. S. Ferro Alloys Corp.

CORUNDUM ORE — 700 bg., Delagoa Bay, Mann, Little & Co.; 723 bg., Delagoa Bay, Order.

COLORS—8 csk. aniline, Havre, Carbic Color & Chemical Co.; 54 pkg. aniline, Havre, Ciba Co.; 107 pkg. do., Rotterdam, Kuttroff, Pickhardt & Co.; 11 csk. earth, Rotterdam A. Hurst & Co.; 4 csk. do., Rotterdam, A. Hurst & Co.; 22 csk. aniline, Rotterdam, H. A. Metz & Pickhardt & Co.; 6 csk. do., Hamburg, H. Co.; 4 csk. do., Rotterdam, Color Service Co.; 9 csk. aniline, Hamburg, Kuttroff, A. Metz & Co.; 10 pkg. do., Hamburg, Franklin Import & Export Co.; 2 bbl do. Genoa, Banca Comm. Italo; 125 csk. venetian red, Liverpool, J. Lee Smith & Co.

CRESOL—2 dr., Liverpool, W. E. Jordan & Bro.; 2 bbl., Hamburg, Order.

CREOSOTE OIL—7,129 tons (in bulk), Antwerp, American Creosoting Co.

DEXTRINE — 97 bg., Rotterdam, Twentsche Bank.

DIVI-DIVI—32 bg., San Juan, Hudson Tea Co.; 100 bg., Curacao, R. Desvernine.

EPSOM SALT—500 bg., Hamburg, Innis, Speiden & Co.

FUSEL OIL—1 dr., Dunkirk, Order; 4 dr., Hamburg, Wilbeck Chemical Corp.; 10 bbl., Hamburg, Schenkers, Inc.; 31 bbl., Hamburg, Order.

GAMBIER—2,125 cs., Asahan, Order.

GLYCERINE—20 dr. Liverpool, Order; 40 dr. crude, Rotterdam, Core & Herbert; 160 csk., Marseilles, Marx & Rawolle; 19 dr. crude, Antwerp, Brown Bros. & Co.; 50 dr., Antwerp, Order.

GRAPHITE—38 bbl., Trieste, A. Hurst; 121 bg., Marseilles, H. W. Peabody & Co.; 132 dr., Genoa, Order.

GUMS—100 cs. damar, Singapore, L. C. Gillespie & Son; 435 bg. damar, 50 cs. do. and 106 bg. copal Singapore, Baring Bros. & Co.; 50 cs. damar, Padang, F. W. Frost & Co.; 100 cs. do., Padang, Order; 274 bg. arabic, Bombay, Guaranty Trust Co.; 80 bg. copal, Sabang, Order; 128 pkg. copal, Hamburg, Equitable Trust Co.; 500 bg. arabic, Port Sudan, Order; 206 bskt. copal, Macassar, Standard Bank of South Africa; 140 bskt. do., Macassar, Irving Bank-Col. Trust Co.; 125 bskt. do., Macassar, Kidder, Peabody & Co.; 447 bskt. do., Macassar, S. Winterbourne & Co.; 1,376 bg. do., Macassar, Order; 100 cs. damar, Padang, W. Schall & Co.; 200 cs. damar, Batavia, Chemical National Bank; 100 cs. do., Batavia, Bank of the Manhattan Co.; 197 bskt. copal, Menada, M. Pennink; 190 bg. copal, Antwerp, Chatham & Phenix National Bank, 1,250 bg. do., Antwerp, Order.

IRON OXIDE—25 csk., Liverpool, L. H. Butcher & Co.; 260 bbl., Malaga, S. L. Libby Corp.; 114 bbl., Malaga, C. J. Osborn Co.; 25 bbl., Malaga, C. B. Chrystal; 189 bbl., Malaga, C. K. Williams & Co.; 44 csk., Liverpool, J. A. McNulty; 10 csk., Liverpool, Order; 25 csk., Antwerp, Order.

IRON POWDER—97 bbl., Bremen, W. Schall & Co.

LOGWOOD—239 tons, St. Marc, Stamford Dyeing Co.

LOGWOOD EXTRACT — 40 csk., Savanna La Mar, J. Campbell Co.; 85 bbl., Cape Haiti, Logwood Mfg. Co.; 75 bbl., Cape Haiti, Clavel & Lindemayer.

LITHOPONE—20 csk., Rotterdam, P. Uhlich & Co.; 1,000 csk. Antwerp, Benjamin Moore & Co.

MINERAL WHITE—240 bg., Liverpool, Hammill & Gillespie.

MAGNESITE—7,200 bg. lump, Madras, Order; 221 csk., Rotterdam, Speiden, Whitfield Co.

MAGNESIUM CHLORIDE—90 dr., Hamburg, Order.

MANGANESE ORE—5,022 tons, Lagos, Order; 573 bg., Antilla, H. S. Predmore.

MANGROVE BARK — 320 bg., Beira, Order.

MYROBALANS—1,524 bg., Bombay, Order; 6,940 bg., Bombay, Order.

NICKEL SULPHATE—150 csk., Havre, Gallagher & Ascher.

NUX VOMICA—369 bg., Madras, Order.

OCHER — 71 csk., Marseilles, American Exchange National Bank; 1,158 csk., Marseilles, Reichard-Coulston, Inc.; 90 csk., Marseilles, American Exchange National Bank; 125 csk., Marseilles, Order.

OILS—China Wood—705 tons (in bulk) discharged at Norfolk, Va., from Hankow, Order; 142 csk., Hankow, Paterson, Boardman & Knapp. **Cod**—300 csk., St. Johns, Swan & Finch Co.; 250 csk., St. Johns, National Oil Products Co. **Coconut**—650 tons (in bulk), Manila, Spencer Kellogg & Sons. **Palm**—641 csk., Lagos, Niger Co.; 1,256 csk., Lagos, Irving Bank-Col. Trust Co. **Rapeseed**—833 tons crude, Liverpool, Order; 50 bbl., Liverpool, Order.

OILSEEDS—Castor—2,852 bg., Bombay, Volkart Bros.; 15,913 bg., Bombay, Order; 23 bg., Port au Prince, S. L. Brinley; 2,100 bg., Santos, Seaboard National Bank; 27 bg., Jeremie, H. P. Botzow.

PITCH—47 bbl. stearine, Hamburg, American Exchange National Bank.

PLATINUM POWDER — 1 cs., Buenaventura, Pacific Metals Co.

PLUMBAGO—94 bbl., Colombo, Order.

POTASSIUM SALTS—75 dr. caustic, Hamburg, Parsons & Petit; 36 csk. prussiate, Liverpool, C. Tennant Sons & Co.; 22 csk. carbonate, Bremen, P. H. Petry & Co.; 5,000 bg. sulphate and 3,250 bg. muriate, Bremen, Potash Importing Corp. of America; 74 csk. bicarbonate, Rotterdam, Mallinckrodt Chemical Works; 2,500 csk. chlorate, Hamburg, Irving Bank-Col. Trust Co.; 100 dr. caustic, Hamburg, Roessler & Hasslacher Chem. Co.; 490 dr. chlorate, Havre, C. Hardy, Inc.; 820,964 kilos muriate, Antwerp, Societe des Potasses d'Alsace; 3,000 bg. sulphate and 5,165 bg. salts, Bremen, Potash Importing Corp. of America; 18 kegs prussiate, Liverpool, C. Tennant Sons & Co.; 5,810 bg. muriate, Antwerp, Societe des Potasses d'Alsace; 100 bbl. alum, Hamburg, E. Suter & Co.; 200 dr. caustic, Hamburg, A. Klipstein & Co.; 15 csk. carbonate, Hamburg, Parsons & Petit; 30 csk. prussiate, Hamburg, Roessler & Hasslacher Chem. Co.; 25 bbl. alum, Hamburg, Order.

PYRIDINE — 7 dr., Hamburg, R. W. Greeff & Co.; 7 bbl., Hamburg, Order; 6 dr., Hamburg, E. Suter & Co.; 16 dr. Hamburg, Order.

QUEBRACHO—2,202 bg., Buenos Aires, Commonwealth Atlantic National Bank; 988 bg., Buenos Aires, A. Barth Leather Co.

QUICKSILVER — 100 flasks, Leghorn, Order.

SAL AMMONIAC—200 bbl., Hamburg, Roessler & Hasslacher Chem. Co.; 68 bbl., Hamburg, Order; 89 bbl., Hamburg, Hans Hinrichs Chem. Co.; 34 csk., Hamburg, Roessler & Hasslacher Chem. Co.

SHELLAC—285 bg., Calcutta, First National Bank of Boston; 48 cs., Rotterdam, C. F. Gerlach; 1000 bg., Calcutta, Standard Bank of South Africa; 1,625 bg., Calcutta, Order; 100 bg., Calcutta, Order.

SILVER SULPHIDE—4 cs., Sov [illegible] Am. Ports, W. Schall & Co.; 8 cs., do., [illegible]r.

SODIUM SALTS — 17,311 bg., [illegible]ate, Valparaiso, Wessel, Duval & Co.; [illegible],050 bg. do., Iquique, Wessel Duval & Co.; [illegible],904 bg. do., Iquique, A. Gibbs & Co.; 13,819 bg. do., Iquique, E. I. du Pont de Nemours & Co.; 6,538 bg. do., Tocopilla, W. R. Grace & Co.; 26,987 bg. do., Taltal, W. R. Grace & Co.; 43 csk. prussiate, Liverpool, C. Tennant Sons & Co.; 70 csk. nitrite, Christiania, Norwegian Products Co.; 35 csk. do, Christiania, Calco Chemical Co.; 19 csk. do., Christiania, Eastman Kodak Co.; 200 cs. cyanide, Havre, International Banking Corp.; 4 csk. salts, Rotterdam, Kuttroff, Pickhardt & Co.; 625 cs. cyanide, Hamburg, Roessler & Hasslacher Chem. Co.; 195 dr. sulphite, Hamburg, C. S. Grant & Co.; 50 cs. cyanide, Liverpool, Order; 30 csk. yellow prussiate, Rotterdam, Order; 4,146 bg. nitrate, Antofagasta, W. R. Grace & Co.; 9,938 bg. do., Iquique, W. R. Grace & Co.; 43 csk. prussiate, Liverpool, C. Tennant & Sons Co.

STARCH — 200 bg. potato, Rotterdam, Archibald & Lewis Co.; 650 bg. do., Rotterdam, Stein, Hall & Co.; 200 bg. do., Rotterdam, Order.

TALC—300 bg., Genoa, C. Mathieu; 200 bg., Genoa, C. B. Chrystal & Co.; 200 bg., Genoa, Kountze Bros.; 500 bg., Genoa, Italian Discount & Trust Co.; 1,000 bg., Genoa Coty, Inc.

TARTAR—39 csk., Naples, Royal Baking Powder Co.; 114 bg., Seville, C. Pfizer & Co.; 340 bg., Marseilles, C. Pfizer & Co.; 370 bg., Marseilles, Royal Baking Powder Co.; 444 bg., Marseilles, N. Kenoe; 50 bg., Southampton, Kidder, Peabody & Co.

VANADIUM — 5,199 bg., Callao, Vanadium Corp. of America.

VALONEA—3,343 bg., Smyrna, Order.

WATTLE BARK—561 bg., Delagoa Bay, Standard Bank of South Africa; 1,646 bg., Delagoa, Order.

WAXES—538 bg. paraffine, Danzig, D. Campbell & Co.; 43 bg. beeswax, Havana, Order; 20 cs. beeswax, Havre, Barrott Co.; 170 bg. vegetable, Hamburg, Equitable Trust Co.; 50 bg. mineral, Hamburg, L. S. Tainter.

WOOL GREASE — 100 bbl., Bremen, J. D. Irwin & Co., 56 bbl. Antwerp, Order; 30 bbl., Bremen, Order.

ZINC OXIDE—50 bbl., Marseilles, Reichard-Coulston, Inc.; 100 csk., Antwerp, A. Klipstein & Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

Industrial Chemicals

Acetone, drums, works	lb.	$0.16 –	$0.16½
Acetic anhydride, 85%, dr.	lb.	.34 –	.36
Acid, acetic, 28%, bbl. 100	lb.	3.12 –	3.37
Acetic, 56%, bbl. 100	lb.	5.85 –	6.10
Acetic, 80%, bbl. 100	lb.	8.19 –	8.44
Glacial, 99½%, bbl. 100	lb.	11.01 –	11.51
Boric, bbl.	lb.	.09 –	.09½
Citric, kegs	lb.	.45½–	.46½
Formic, 85%	lb.	.11½–	.11½
Gallic, tech.	lb.	.45½–	.47
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.12½–	.13
22% tech., light, bbl.	lb.	.06 –	.06½
Muriatic, 18° tanks 100	lb.	.80 –	.85
Muriatic, 20°, tanks 100	lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½–	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.09½–	.09¾
Phosphoric, 50% carboys	lb.	.07 –	.08
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	8.00 –	9.00
Sulphuric, 60°, drums	ton	12.00 –	13.00
Sulphuric, 66°, tanks	ton	13.00 –	14.00
Sulphuric, 66°, drums	ton	17.00 –	18.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.26 –	.27
Tartaric, domestic, bbl.	lb.	.29 –	.30
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, wks.	lb.	.30 –	.....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.89 –	.....
Denatured, 190 proof No. 1, special bbl.	gal.	.61 –	.....
No. 1, 190 proof, special, dr.	gal.	.55 –	.....
No. 1, 188 proof, bbl.	gal.	.65 –	.....
No. 1, 188 proof, dr.	gal.	.58 –	.....
No. 5, 188 proof, bbl.	gal.	.60 –	.....
No. 5, 188 proof, dr.	gal.	.55 –	.....
Alum [illegible]monia, lump, bbl.	lb.	.03½–	.04
P[illegible] lump, bbl.	lb.	.02¾–	.03¼
C[illegible]e, lump, potash, bbl.	lb.	.05½–	.06
Alu[illegible]m sulphate, com., [illegible]s 100	lb.	1.35 –	1.40
Iron free, bags	lb.	2.35 –	2.45
Aqua ammonia, 26°, drums	lb.	.06½–	.06¾
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd. tech., casks	lb.	.12½–	.12¾
Nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.60 –	3.75
Antimony oxide, white, bbl.	lb.	.12 –	.12½
Arsenic, white, powd., bbl.	lb.	.06½–	.07
Red, powd., kegs	lb.	.14½–	.15½
Barium carbonate, bbl.	ton	55.00 –	56.00
Chloride, bbl.	ton	70.00 –	72.00
Dioxide, 88%, drums	lb.	.17½–	.18
Nitrate, casks	...	.07½–	.07¾
Blanc fixe, dry, bbl.	lb.	.03½–	.04
Bleaching powder, f.o.b. wks., drums 100	lb.	1.90 –	.....
Spot N. Y. drums 100	lb.	2.20 –	2.25
Borax, bbl.	lb.	.05 –	.05½
Bromine, cases	lb.	.34 –	.38
Calcium acetate, bags 100	lb.	3.00 –	3.05
Arsenate, dr.	lb.	.08 –	.08½
Carbide, drums	lb.	.05 –	.05¼
Chloride, fused, dr. wks.	ton	21.00 –	.....
Gran. drums works	ton	27.00 –	.....
Phosphate, mono, bbl.	lb.	.06½–	.07½
Carbon bisulphide, drums	lb.	.06 –	.06½
Tetrachloride, drums	lb.	.06½–	.07
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04¾
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04½–	.....
Contract, tanks, wks.	lb.	.04½–	.....
Cylinders, 100 lb., wks.	lb.	.05½–	.07½
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	15.00 –	16.00
Copper carbonate, bbl.	lb.	.17 –	.17½
Cyanide, drums	lb.	.49 –	.50
Oxide, kegs	lb.	.16 –	.16½
Sulphate, dom., bbl. 100	lb.	4.40 –	4.65
Imp. bbl. 100	lb.	4.37½–	.....
Cream of tartar, bbl.	lb.	.20½–	.21
Epsom salt, dom., bbl. 100	lb.	1.75 –	2.00
Imp., tech., bags 100	lb.	1.35 –	1.40
U.S.P., dom., bbl. 100	lb.	2.10 –	2.35
Ether, U.S.P., dr concent'd.	lb.	.13 –	.14
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Acetate, 99%, dr.	gal.	1.08 –	1.10
Formaldehyde, 40%, bbl.	lb.	.09 –	.09½
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.25 –	.....
Fusel oil, ref., drums	gal.	4.00 –	4.50
Crude, drums	gal.	3.00 –	3.10
Glaubers salt, wks., bags 100	lb.	1.20 –	1.40
Imp., bags 100	lb.	.85 –	.95
Glycerine, c. p., drums extra	lb.	.18½–	.19
Crude 80%, loose	lb.	.12 –	.12½
Hexamethylene, drums	lb.	.65 –	.70

THESE prices are first-hand quotations in the New York market for industrial chemicals, coal-tar products and related materials used in the industries that produce

Dyes	**Paper and Pulp**
Paint and Varnish	**Petroleum**
Ceramic Materials	**Soap**
Fertilizers	**Explosives**
Rubber	**Food Products**
Sugar	**Metal Products**

Whenever available these prices are those of the American manufacturer. If for material f.o.b. works or on a contract basis, quotations are so designated. All prices refer to large quantities in original packages.

Lead:			
White basic carbonate, dry, casks	lb.	$0.10 –	.....
White, basic sulphate, casks	lb.	.09½–	.....
White, in oil, kegs	lb.	1194–	.....
Red, dry, casks	lb.	.11 –	.....
Red, in oil, kegs	lb.	.13¼–	$0.13½
Acetate, white crys., bbl.	lb.	.14½–	.....
Brown, broken, casks	lb.	.13½–	.....
Arsenate, white crys., bbl.	lb.	.16 –	.18
Lime-Hydrated, b.g., wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lump, bbl. 280	lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½–	.....
Lithopone, bags	lb.	.06 –	.06½
Magnesium carb., tech., bags	lb.	.07 –	.08
Methanol, 95%, bbl.	gal.	.74 –	.76
97%, bbl.	gal.	.76 –	.79
Pure, tanks	gal.	.76 –	.....
drums	gal.	.78 –	.80
bbl.	gal.	.83 –	.85
Methyl-acetone, t'ks.	gal.	.70 –	.....
Nickel salt, double, bbl.	lb.	.09½–	.10
Single, bbl.	lb.	.10 –	.11
Orange mineral, csk.	lb.	.14 –	.14¼
Phosgene	...	.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Yellow, cases	lb.	.37½–	.40
Potassium bichromate, casks	lb.	.08½–	.08¾
Bromide, gran., bbl.	lb.	36 –	.38
Carbonate, 80–85%, calcined, casks	lb.	.05 –	.06½
Chlorate, powd.	lb.	.06¾–	.08¼
Cyanide, drums	lb.	.47 –	.52
First sorts, cask	lb.	.08¼–	.08½
Hydroxide (caustic potash) drums	lb.	.07½–	.07¾
Iodide, cases	lb.	3.65 –	3.75
Nitrate, bbl.	lb.	.06 –	.07¾
Permanganate, drums	lb.	.12½–	.12¾
Prussiate, red, casks	lb.	.37 –	.38
Prussiate, yellow, casks	lb.	.16½–	.17
Salammoniac, white, gran., casks, imported	lb.	.06 –	.06½
White, gran., bbl., domestic	lb.	.07¼–	.08
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl. 100	lb.	1.20 –	1.40
Salt cake (bulk) works	ton	16.00 –	17.00
Soda ash, light 58% flat, bulk, contract 100	lb.	1.25 –	.....
bags, contract 100	lb.	1.38 –	.....
Dense, bulk, contract, basis 58% 100	lb.	1.35 –	.....
bags, contract 100	lb.	1.45 –	.....
Soda, caustic, 76%, solid, drums contract 100	lb.	3.10 –	.....
Caustic, ground and flake, contracts, dr. 100	lb.	3.50 –	3.85
Caustic, solid, 76% f.a.s. N. Y. 100	lb.	2.85 –	3.05
Sodium acetate, works, bbl.	lb.	.05 –	.05¼
Bicarbonate, bulk 100	lb.	1.75 –	.....
Bichromate, casks	lb.	.06¾–	.06¾
Bisulphate (niter cake)	ton	6.00 –	7.00
Bisulphite, powd., U.S.P., bbl.	lb.	.04¼–	.04½
Chlorate, kegs	lb.	.06½–	.06¾
Chloride	long ton	12.00 –	13.00
Cyanide, cases	lb.	.19 –	.22
Flouride, bbl.	lb.	.08½–	.09
Hyposulphite, bbl.	lb.	.02½–	.02½
Nitrite, casks	lb.	.09½–	.09¾
Peroxide, powd., cases	lb.	.23 –	.27
Phosphate, dibasic, bbl.	lb.	.03½–	.03¾
Prussiate, yel. bbl.	lb.	.09 –	.09¼

Salicylate, drums	lb.	$0.38 –	$0.40
Silicate (40°, drums) 100	lb.	.75 –	1.16
Silicate (60°, drums) 100	lb.	1.75 –	2.00
Sulphide, fused, 60-62%, drums	lb.	.02¾–	.03¼
Sulphite, crys., bbl.	lb.	.02 –	.02¼
Strontium nitrate, powd., bbl	lb.	.09 –	.09½
Sulphur chloride, yel drums	lb.	.04½–	.05
Crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Flour, bag 100	lb.	2.25 –	2.35
Dioxide, liquid, cyl.	lb.	.08 –	.08½
Tin bichloride, bbl.	lb.	.13¾–	.....
Oxide, bbl.	lb.	.54 –	.....
Crystals, bbl.	lb.	.35 –	.....
Zinc carbonate, bags	lb.	.12 –	.14
Chloride, gran., bbl.	lb.	.06 –	.07½
Cyanide, drums	lb.	.40 –	.41
Dust bbl.	lb.	.08 –	.08½
Oxide, lead free, beg	lb.	.07⅜–	.....
5% lead sulphate bags	lb.	.06⅞–	.....
French, red seal, bags	lb.	.09⅜–	.....
French, green seal, bags	lb.	.10⅝–	.....
French, white seal, bbl.	lb.	.11⅞–	.....
Sulphate, bbl. 100	lb.	3.25 –	3.50

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.62 –	$0.65
Alpha-naphthol, ref., bbl.	lb.	.65 –	.75
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl.	lb.	.19 –	.21
Anthracene, 80%, drums	lb.	.70 –	.75
Anthraquinone, 25%, drums.	lb.	.75 –	.80
Benzaldehyde U.S.P., tech., drums	lb.	.70 –	.72
Benzene, pure, tanks, works	gal.	.25 –	.....
Benzene, 90%, tanks, works	gal.	.23 –	.....
Benzidine base, bbl.	lb.	.80 –	.81
Benzyl chloride, ref. carboys.	lb.	.35 –	.....
Benzyl chloride, tech., drums.	lb.	.25 –	.....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresylic acid, 97%, drums	gal.	.64 –	.66
95-97%, drums, works	gal.	.60 –	.62
Dichlorbenzene, drums	lb.	.07 –	.08
Dinitrobenzene, bbl.	lb.	.15 –	.17
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
H-acid, bbl.	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.90 –	.95
Monochlorbenzene, drums	lb.	.08 –	.10
Naphthalene, flake, bbl.	lb.	.04¾–	.05¼
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62½
Nitrobenzene, drums	lb.	.09 –	.09
Nitro-naphthalene, bbl.	lb.	.25 –	.27
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl.	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.10 –	.11
Ortho-toluidine, bbl.	lb.	.14 –	.16
Para-aminophenol, base, kegs	lb.	1.15 –	1.20
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Para-nitraniline, bbl.	lb.	.68 –	.70
Para-nitrotoluene, bbl.	lb.	.50 –	.55
Para-phenylendiamine, bbl.	lb.	1.35 –	1.45
Para-toluidine, bbl.	lb.	.75 –	.80
Phenol, U.S.P., dr.	lb.	.24 –	.26
Picric acid, bbl.	lb.	.20 –	.22
Pitch, tanks, works	ton	27.00 –	30.00
Pyridine, imp., drums	gal.	4.15 –	4.25
Resorcinol, tech., kegs	lb.	1.30 –	1.40
Resorcinol, pure, kegs	lb.	2.00 –	2.25
R-salt, bbl.	lb.	.50 –	.55
Salicylic acid, tech., bbl.	lb.	.32 –	.33
Salicylic acid, U.S.P., bbl.	lb.	.35 –	.....
Solvent naphtha, water-white, tanks	gal.	.24 –	.25
Crude, tanks	gal.	.21 –	.22
Sulphanilic acid, crude, bbl.	lb.	.16 –	.18
Tolidine, bbl.	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	.....
Toluene, drums, works	gal.	.31 –	.....
Xylidine, drums	lb.	.40 –	.42
Xylene, 5 deg.-tanks	gal.	.38 –	.40
Xylene, com., tanks	gal.	.25 –	.27

Naval Stores

Rosin B-D, bbl. 280	lb.	$7.25 –	$7.35
Rosin E-I, bbl. 280	lb.	7.35 –	7.45
Rosin K-N, bbl. 280	lb.	7.35 –	7.45
Rosin W.G.-W.W., bbl. 280	lb.	8.20 –	8.75
Turpentine, spirits of, bbl.	gal.	.85 –	.86
Wood, steam dist., bbl.	gal.	.74 –	.75
Wood, dest. dist., bbl.	gal.	.55 –	.56
Pine tar pitch, bbl. 200	lb.	5.50 –	.....
Tar, kiln burned, bbl. 500	lb.	10.50 –	.....
Rosin oil, first run, bbl.	gal.	.42 –	.....
Pine tar oil, com'l.	gal.	.30 –	.....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03¾ –	$0.05¼
Grease, yellow, loose	lb.	.08½ –	.08¾
Lard oil, Extra No. 1, bbl.	gal.	.86 –	.88
Lard compound, bbl.	lb.	.13½ –	.13¾
Neatsfootoil, 20 deg. bbl.	gal.	1.35 –	.....
Oleo Stearine		.13½ –	.....
Oleo oil, No. 1, bbl.	lb.	.22 –	.22½
Red oil, distilled, d.p. bbl.	lb.	.09½ –	.09¾
Tallow, extra, loose works	lb.	.09½ –	.....
Tallow oil, acidless, bbl.	gal.	.86 –	.87

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.16½ –	$0.17
Castor oil, No. 1, bbl.	lb.	.17½ –	.17½
Chinawood oil, bbl.	lb.	.15½ –	.15½
Coconut oil, Ceylon, bbl.	lb.	.10½ –	.....
Ceylon, tanks, N. Y.	lb.	.10 –	.....
Corn oil, crude, bbl.	lb.	.11½ –	.11¾
Crude, tanks, (f.o.b. mill)	lb.	.10 –	.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09 –	.....
Summer yellow, bbl.	lb.	.11½ –	.11¾
Linseed oil, raw, car lots, bbl.	gal.	1.05 –	.....
Raw, tank cars (dom.)	gal.	.99 –	.....
Boiled, cars, bbl. (dom.)	gal.	1.07 –	.....
Olive oil, denatured, bbl.	gal.	1.18 –	1.22
Sulphur, (foots) bbl.	lb.	.09½ –	.09
Palm, Lagos, casks	lb.	.09½ –	.09½
Niger, casks	lb.	.08½ –	.08¾
Palm kernel, bbl.	lb.	.10½ –	.....
Peanut oil, crude, tanks (mill)	lb.	.12½ –	.....
Refined, bbl.	lb.	.16 –	.16½
Perilla, bbl.	lb.	.14 –	.14¼
Rapeseed oil, refined, bbl.	gal.	.96 –	.96½
Sesame, bbl.	lb.	.12½ –	.13½
Soya bean (Manchurian), bbl	lb.	.12 –	.12½
Tank, f.o.b. Pacific Coast	lb.	.11 –	.11½

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.62 –	$0.65
Menhaden, light pressed, bbl.	gal.	.68 –	.70
White bleached, bbl.	gal.	.70 –	.71
Crude, tanks (f.o.b. factory)	gal.	.52½ –	.55
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochineal, bags	lb.	.33 –	.35
Cutch, Borneo, bales	lb.	.04½ –	.04¾
Rangoon, bales	lb.	.13½ –	.14½
Dextrine, corn, bags 100	lb.	4.52 –	4.79
Gum, bags 100	lb.	4.82 –	5.09
Divi-divi, bags	ton	42.00 –	43.00
Fustic, sticks	ton	30.00 –	35.00
Chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.16 –	.16½
Logwood, sticks	ton	25.00 –	26.00
Chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	170.00 –	180.00
Domestic, bags	ton	50.00 –	55.00
Starch, corn, bags 100	lb.	3.87 –	4.14

Extracts

Archil, conc., bbl.	lb.	$0.16 –	$0.19
Chestnut, 25% tannin, tanks	lb.	.01½ –	.02½
Divi-divi, 25% tannin, bbl.	lb.	.05 –	.05
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09½
Gambier, liq., 25% tannin, bbl.	lb.	.11 –	.11
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, liquid, 51°, bbl.	lb.	.12 –	.13
Logwood, crys., bbl.	lb.	.14 –	.15
Liq., 51°, bbl.	lb.	.07½ –	.08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Quebracho, solid, 65% tannin, bbl.	lb.	.04½ –	.04¾
Sumac, dom., 51°, bbl.	lb.	.06½ –	.06¾

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.09 –	$0.11
spot, cases	lb.	.12 –	.16
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Prussian, bbl.	lb.	.36 –	.37
Ultramarine, bbl.	lb.	.07 –	.35
Browns, Sienna, Ital., bbl.	lb.	.05 –	.12
Sienna, Domestic, bbl.	lb.	.03 –	.03½
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens-Chrome, C.P.Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.10½ –	.11½
Paris, bulk	lb.	.24 –	.26
Reds, Carmine No. 40, tins	lb.	4.25 –	4.50
Iron oxide red, casks	lb.	.08 –	.12
Para toner, kegs	lb.	.95 –	1.00
Vermilion, English, bbl.	lb.	1.30 –	1.35
Yellow, Chrome, C.P. bbls.	lb.	.17 –	.17½
Ocher, French, casks	lb.	.02 –	.03

Waxes

Beeswax, crude, Afr. bg.	lb.	$0.29 –	$0.29½
Refined, light, bags	lb.	.33 –	.34
Candellila, bags	lb.	.26 –	.27
Carnauba, No. 1, bags	lb.	.35 –	.37
No. 2, North Country, bags	lb.	.26 –	.28
No. 3, North Country, bags	lb.	.24 –	.25
Japan, cases	lb.	$0.16 –	$0.17
Montan, crude, bags	lb.	.06 –	.06½
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.06¼ –	.06½
Crude, scale 124-126 m.p. bags	lb.	.05¾ –	.05¾
Ref., 118-120 m.p. bags	lb.	.06 –	.06½
Ref., 123-125 m.p., bags	lb.	.06½ –	.06¾
Stearic acid, sgle. pressed, bags	lb.	.11 –	.11½
Double pressed, bags	lb.	.11½ –	.12

Fertilizers

Acid phosphate, 16%, wks.	ton	$7.50 –	$7.75
Ammonium sulphate, bulk f.o.b. works 100	lb.	2.70 –	2.75
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	4.50 –	.....
Nitrate of soda, bags 100	lb.	2.40 –	.....
Tankage, high grade, f.o.b. Chicago	unit	2.75 –	3.00
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.25 –	3.70
Tennessee, 75%	ton	6.75 –	7.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Sulphate, bags, 90%	ton	45.85 –	.....
Double manure salt, bgs.	ton	26.35 –	.....
Kainit, 14%, bgs	ton	10.25 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.33½ –	.....
Upriver coarse	lb.	.23½ –	.....
Plantation—First latex crepe	lb.	.33 –	.....
Ribbed smoked sheets	lb.	.32¾ –	.33

Gums

Copal, Congo, amber, bags	lb.	$0.08 –	$0.10
East Indian, bold, bags	lb.	.13 –	.14
Manila, amber, bags	lb.	.14 –	.16
Damar, Batavia, cases	lb.	.24½ –	.25
Singapore, No. 1, cases	lb.	.27 –	.28
Singapore, No. 2, cases	lb.	.18 –	.18½
Kauri, No. 1, cases	lb.	.58 –	.64
Ordinary chips, cases	lb.	.21 –	.22
Manjak, Barbados, bags	lb.	.06 –	.09

Shellac

Shellac, orange fine, bags	lb.	$0.67 –	$0.68
Orange superfine, bags	lb.	.69 –	.70
Bleached, bonedry	lb.	.73 –	.75
T. N., bags	lb.	.65 –	.66

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	sh. ton	$300.00 –	$350.00
Shingle, f.o.b., Quebec	sh. ton	50.00 –	60.00
Cement, f.o.b., Quebec	sh. ton	15.00 –	20.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	17.00 –	17.50
Grd., off-color, f.o.b., Balt	net ton	13.00 –	14.00
Floated, f.o.b., St. Louis, bbl.	net ton	23.00 –	24.00
Crude f.o.b. mines, bulk	net ton	8.00 –	9.00
Casein, bbl., tech.	lb	.10½ –	.12½
China clay (kaolin) crude, No. 1, f.o.b. Ga.	net ton	7.00 –	8.00
Powd., f.o.b. Ga.	net ton	14.00 –	20.00
Crude, f.o.b. Va.	net ton	6.00 –	8.00
Ground, f.o.b. Va.	net ton	13.00 –	19.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 –	7.25
No. 2 f.o.b. N.C.	long ton	4.50 –	5.00
No. 1 gr'd. N.C.	long ton	15.32 –	21.00
No. 1 Canadian, f.o.b., mill, powd.	long ton	20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl.	lb.	.05½ –	.06
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.12 –	.12
Tragacanth, sorts, bags	lb.	.50 –	.55
No. 1, bags	lb.	1.20 –	.....
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N.Y.	ton	50.00 –	55.00
Magnesite, calcined	ton	32.00 –	35.00
Pumice stone, imp., casks	lb.	.03 –	.40
Dom., lump, bbl.	lb.	.06 –	.08
Dom., ground, bbl.	lb.	.03 –	.05
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.25
Sand blast, f.o.b. Ind.	ton	2.25 –	3.50
Amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 –	.....
Glass sand, f.o.b. Ill.	ton	2.00 –	2.50
Soapstone, coarse, f.o.b., Vt., bags	ton	7.50 –	8.00
Talc. 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 –	.....
200 mesh, f.o.b., Ga.	ton	9.50 –	10.00
325 mesh, f.o.b. New York, grade A	ton	14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.75 –	$2.85
Corning	bbl.	1.50 –	.....
Cabell	bbl.	1.45 –	.....
Somerset	bbl.	1.55 –	.....
Illinois	bbl	1.37 –	.....
Indiana	bbl.	1.38 –	.....
Kansas and Okla. under 28 deg.	bbl.	.75 –	.85
California, 35 deg. and up	bbl.	1.40 –	.....

Gasoline, Etc.

Motor gasoline steel bbls.	gal.	$0.14 –	.....
Naphtha, V. M. & P. deod, steel bbls.	gal.	.13 –	.....
Kerosene, ref. tank wagon	gal.	.13 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.08½ –	.....
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.33 –	$0.36
Bloomless, 30@31 grav.	gal.	.24 –	.....
Paraffin, pale 885 vis.	gal.	.15½ –	.16½
Spindle, 200, pale	gal.	.21 –	.21½
Petrolatum, amber, bbls.	lb.	.04¼ –	.04½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	45–47
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	40–43
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	33–37
Magnesite brick, 9-in. straight (f.o.b. wks)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
9-in. sizes, f.o.b., Birmingham	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	35–38
Silicon carbide refract brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls	ton	$200.00 –	......
Ferrochromium, per lb. of Cr, 1-2% C.	lb.	.30 –	......
4-6% C	lb.	.12½ –	......
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	100.00 –	......
Spiegeleisen, 19-21% Mn.	gr. ton	33.00 –	35.00
Ferromolybdenum, 50-60% Mo, per lb. Mo.	lb.	2.00 –	2.25
Ferrosilicon, 10-12%	gr. ton	39.50 –	43.50
50%	gr. ton	72.00 –	75.00
Ferrotungsten, 70-80% per lb. of W.	lb.	.88 –	.90
Ferro-uranium, 35-50%, of U, per lb. of U.	lb.	4.50 –	......
Ferrovanadium, 30-40%, per lb. of V.	lb.	3.25 –	3.75

Ores and Mineral Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	.....
C.i.f. Atlantic seaboard	ton	18.50 –	24.00
Coke, fdry., f.o.b. ovens	ton	4.00 –	4.50
Coke, furnace, f.o.b. ovens	ton	3.00 –	3.10
Fluorspar, gravel, f.o.b. mines, Illinois	ton	17.50 –	18.50
Ilmenite, 52% TiO_2 Va.	lb.	.01½ –	.....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.41 –	.45
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.70 –	.75
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½ –	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.12 –	.....
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	.....
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten ore, scheelite, 60% WO_3 and over	unit	9.00 –	.....
Tungsten, wolframite, white, 60% WO_3	unit	8.75 –	9.00
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	12.50
Vanadium pentoxide, 99%	lb.	12.50 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.13½ –	$0.13¾
Aluminum, 98 to 99%	lb.	.27 –	.28
Antimony, wholesale, Chinese and Japanese	lb.	.11½ –	.11¾
Nickel, 99%	lb.	.29 –	.30
Monel metal, shot and blocks	lb.	.32	
Tin, 5-ton lots, Straits	lb.	.51¾	
Lead, New York, spot	lb.	.0840	
Zinc, spot, New York	lb.	.0675	
Silver (commercial)	oz.	.70½	
Cadmium	lb.	.55– .60	
Bismuth (508 lb. lots.)	lb.	1.85 1.90	
Cobalt	lb.	2.50–3.00	
Magnesium, ingots, 99%	lb.	.90–95	
Platinum, refined	oz.	118.00	
Mercury 75	lb.	71.00	
Tungsten powder	lb.	.95–1.00	

Industrial Developments of the Week

New Construction and Machinery Requirements in the Process Industries

Some Opportunities This Week

Cannery	Collingwood, Ont.
Cannery	Dorchester, Wis.
Celotex	Amesville, La.
Cement	Collingwood, Ont.
Confectionery	Cambridge, Mass.
Enameling	Oakland, Calif.
Gas and Coke Plant	Hartford, Conn.
Laboratory	Buffalo, N. Y.
Laboratory	Fergus, Ont.
Linoleum	Hutchinsons Mills, N. J.
Matches	Duluth, Minn.
Medicine	Lynn, Mass.
Oils, grease, etc.	Woburn, Mass.
Oil Refining	Fort Collins, Colo.
Paper	Green Bay, Wis.
Paper	Three Rivers, Que.
Plating	Cambridge, Mass.
Rubber	Newark, Del.
Rubber	Trenton, N. J.

New England

Conn., Hartford—The Koppers Co., Union Trust Bldg., Pittsburgh, Pa., has made a proposition to the city regarding the construction of a gas and coke plant. The City Gas & Light Co., E. E. Eysenbach, general manager, to manufacture the gas and the Koppers Co. to handle the coal and coke business. Estimated cost $10,000,000.

Conn., Middletown—Russell Mfg., Co., manufacturers of belting, halters and cotton webbing, awarded the contract for the construction of a 2 story and basement, 144 x 48 ft. belt treating building to D. O'Brien & Sons Co., 15 McDonough Pl. Estimated cost $40,000.

Mass., Cambridge—General Steel & Rubber Stamp Co., Harvard and 6th Sts. is in the market for complete plating plant.

Mass., Cambridge—New England Confectionary Co., 253 Summer St., Boston, plans the construction of a factory on Massachusetts Ave., and Albany St. Cost will exceed $40,000. Architect not selected.

Mass., Lynn—Lydia Pinkham Medicine Co., Western Ave., awarded the contract for a 4 story and basement, 57 x 75 ft. addition to plant, to Pultz., Inc., 173 Milk St., Boston. Estimated cost $80,000.

Mass., Woburn—Woburn Degreasing Co., manufacturers of oils, greases, etc., plans to rebuild their plant on Bedford St., recently destroyed by fire. Estimated cost $100,000. Architect not selected.

Middle Atlantic

Del., Newark—The Continental Fibre Co., manufacturers of vulcanized rubber, awarded the contract for the construction of a 2 story, 139 x 280 ft. building to be used for phenolic condensation, to The Austin Co., Cleveland, Ohio.

N. J., Hutchinson's Mills, (Trenton P. O.) —W. & J. Sloane, 5th Ave. and 47th St., New York, plans the construction of a linoleum plant. Architect not selected.

N. J., Trenton—Fisk Flap Tube Co., 15 East State St., Paul H. Weidell, Vice-Pres., plans the construction of a rubber factory, first unit to be 1 story, 50 x 150 ft. Estimated cost $50,000. Architect not selected.

N. Y., Brooklyn—Widder Dye & Chemical Co., 155 Bway., is in the market for a motor driven agitator for mixing.

This free weekly service is published in the interest of the buyer and the seller, to bring them together and get machinery moving. These leads are reported by our authorized correspondents who are instructed to verify every item. Requirements for new machinery for use in the process industries will be published here free of charge.

N. Y., Buffalo—E. Harrington, 425 Crescent Ave., plans the construction of a laboratory, estimated to cost $100,000.

N. Y., Hoosick Falls—Colasta Co., R. W. Wales, Purch. Agt., is in the market for 1 mixer, size 6, style 1/11, one hot rolls as used in ink, rubber, etc., industry, approximately 10 in. diam. x 16 in. face, steam heated, geared to various speeds, etc.

N. Y., Schenectady—General Electric Co., River Rd., had plans prepared for a 5 story 80 x 255 ft. laboratory, with 1 story 100 x 155 ft. wing. Estimated cost $500,000.

Pa., Philadelphia—U. S. Pencil Co., J. T. Furst, 60th St. and Baltimore Ave., awarded the contract for the construction of a 2 story and basement, 218 x 60 ft. factory and office building on Woodland Ave., near 60th St., to McCloskey Co., 1620 West Thompson St. Estimated cost $65,000.

South

La., Amesville—The Celotex Co., is having preliminary plans prepared for the construction of a 1 and 2 story woodworking plant, including machinery, power equipment, etc., to manufacture board from sugar cane. Plans to raise capacity of plant from 350,000 board ft. of celotex to 1,000,000 ft. per day. Private plans.

Middle West

Mich., Detroit—Carey & Esselstyn, Engineers, 602 Hoffman Bldg., are in the market for 50 glass grinding and polishing machines with motors and starters, for glass plant of Mississippi Glass Co., 4070 North Main St., St. Louis, Mo.

Wis., Dorchester — Dorchester Canning Co., c/o F. Nagel, will soon receive bids for the construction of a 2 story cannery, estimated cost $75,000. Private plans. Owner is in the market for canning and conveying machinery.

Wis., Green Bay—Fort Howard Paper Co., State St., awarded the contract for a 2 story and basement, 120 x 122 ft. addition to paper mill, to H. J. Selmer Co., McCartney Bank Bldg., Milwaukee. Estimated cost $70,000. Owner is in the market for special paper making machinery.

West of Mississippi

Colo., Fort Collins—Fort Collins Refining Co., recently organized, plans the construction of an oil refinery, to have daily capacity of 3,500 bbls. Estimated cost $750,000. D. O. Norton, O. H. and N. E. Bonner, Fort Collins, are interested.

Kans., Wichita—Derby Oil Co., Orpheum Bldg., is having plans prepared for the construction of a 1 story and basement, 100 x 100 ft. lubricating building. Estimated cost $50,000. Private plans.

Minn., Duluth—Acme Match Corporation, 609 Lyceum Bldg., will receive bids until Nov. 1, for a 2 story, 90 x 150 ft. factory, on 40th Ave. W., and Travis St. Estimated cost $75,000. Holstead & Sullivan, 407 Palladio Bldg., are engineers and architects. Owner is in the market for machinery and equipment.

Far West

Calif., Oakland—Quality Enameling & Porcelaining Co., 1634 Howard St., San Francisco, L. P. Nutchers, Pres., plans the construction of a 1 story, 180 x 150 ft. factory.

Canada

N. B., Devon—C. Orser, Picton, Ont., is in the market for complete equipment and machinery for canning factory.

Ont., Collingwood — Smart Bros., Ltd., plans the construction of a canning factory. Estimated cost $50,000. Owner is in the market for equipment.

Ont., Collingwood—H. Williams, is in the market for equipment for manufacturing cement products, blocks, tile, etc.

Ont., Fergus—School Bd., H. W. Clarke, Chr., plans the construction of a high school, including physics and chemistry laboratories. Estimated cost $100,000. Owner is interested in prices on materials, equipment, etc.

Que., Three Rivers—Wayagamack Pulp & Paper Co., Ltd., plans the construction of a 2 story, 400 x 250 ft. newsprint paper plant on Potherie Island. Estimated cost $2,000,000. Pringle & Sons, 20 St. Nicholas Ave., Montreal, are engineers.

South America

S. A., Peru—Cerro de Pasco Copper Corporation, 15 Broad St, New York City, is receiving bids for structural steel for the Cottrell precipitation plant, the company to do the erecting. Bids for the electrical equipment will soon be called. Estimated cost including equipment $300,000.

Incorporations

Brown Herb Co., New York City, medicinal products, $100,000; Lyman Brown, Robert A. Brown, Sea Gate, N. Y.; Edgar Beekman, Bronxville, N. Y.

Gasoline Dye & Chemical Co., Manhattan, $30,000; S. Passin, M. J. Levinson, H. Schaffer.

Clegg Chemical Co., Manhattan, oil and paints, $10,000; C. J. & L. Clegg, S. Isaacs.

Robinson, Butler, Hemingway & Co., New York City, coal tar and tar products, $50,000; Loren N. Wood, Bound Brook, N. J.

Boston Drug & Chemical Co., Boston, Mass.; drugs and chemicals; $50,000; Maurice Harrison, Boston; George J. Place, Swampscott; Everett W. White.

New York Liquid Bleach Co., Cleveland, Ohio, $10,000; A. Dissette, Leonard G. Daniels.

American Industrial Chemical Co., Wilmington, Del., $6,250,000; John J. Rascob, Wilmington.

Valley Chemical Products, Wilmington, Del., $50,000.

Rocky Mountain Paint Co., Wilmington, Del., $800,000.

Cleansit Chemical Corp., Wilmington, Del., $100,000.